The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XLVIII
No. 1231

SATURDAY, JANUARY 30, 1943
REGISTERED AS A NEWSPAPER

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited.

VOL. XLVIII
No. 1231

January 30, 1943

Annual Subscription, 21s.
Overseas, 26s.

Synthetic Rubber

LACK of scientific control in Whitehall, or perhaps more properly the absence of scientists and technologists with chemical knowledge in the higher positions of Government, has cost this country a great deal in wasted opportunities. The Government may at any time seek advice from scientific and technical men, but if that advice runs contrary to political expediency it is not taken. This was the subject of our cartoon on January 16, and the lesson is still further hammered home by Dr. Harry Barron in the preface to his book *Modern Synthetic Rubbers* (Chapman and Hall, 25s.) which has just been published.

Since synthetic rubber is a specific instance of what we have in mind, it is worth while pursuing Dr. Barron's views at some length. So long ago as October, 1936, he advocated publicly that as a form of long-term insurance the Government should take an interest in the production of synthetic rubber. It appears that on other occasions he warned the country of the danger of allowing synthetic rubber to be developed by foreign countries and not in this country. The development of the synthetic rubber industry goes deeper than the provision of a rubber substitute, important though that may be. This is the case with many similar industries. We have in these columns, for example, stressed the danger of not having our own petroleum refining industry: we have pointed out that by allowing the bulk of our refining to be done abroad we are cutting ourselves off from a vast organic chemical industry such as is now being built up in the U.S.A., in Russia, and no doubt in other countries. It is criminal folly not to take the long view of chemical processes. Synthetic rubbers are a form of plastic, and they thus have a great deal to do with the development of the plastics industry. Dr. Barron points out that the growth of the plastics industry means that plastics will for the future play a very important part in building aircraft, motor cars, ships, houses, and structures generally. It means that they will have a very great influence on many industries, and our livelihood, comfort and happiness may be vitally bound up in their use.

The important thing is that in many instances, to quote Dr. Barron, "precisely those plastics which will be of such pre-eminent importance are also involved in the production of synthetic rubber, either

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directly or as by-products. That single fact enables them to be produced on a very large scale and very cheaply, since all the major costs are borne by the synthetic rubber production. In other words, synthetic rubber paves the way for the Plastics Age. Together with the synthetic rubber industry," he says, "you will have a healthy expanding plastics industry; without it, the thermoplastic industry will inevitably be a hothouse plant constantly requiring artificial stimulation. And thus many dependent industrial activities will be correspondingly affected—adversely. In Great Britain, the exigencies of war have brought home the fact that in many directions we are considerably behind in technical progress. We have certainly been travelling on the train of progress, but with our backs to the engine—and third class! There has been no money available for production. We can only see the receding landscape. Our technical men have not been encouraged to see the new horizons and opportunities that are continually being opened up."

This indictment of the trend of technical progress in this country and of the lack of encouragement from successive governments can be paralleled in other industries. Why was it, for example, that the Government found no all-British firm capable of building nitric acid plants when war broke out, a fact to which we alluded when dealing with Mr. Manning's paper on the subject? The plain fact is that whereas in Germany, America, Russia, and Japan, far-seeing governments have recognised the importance of developing chemical processes, including both the chemical manufacturing industry and the chemical plant industry, in this country, apart from a little stimulation given by way of tariff protection following the disastrous experience at the opening of the last German war, the chemical industry and the chemical plant industry have been allowed to drift on, pitting their single-handed weight against the combined weight of industry and government in other countries.

Dr. Barron's book comes at a time when synthetic rubber has never been more prominent in the public mind. The stimulus of war has brought rubber technology to an interesting position in which synthetically produced rubber-like materials are taking the place of true natural rubber. Their manufacture is making rapid strides and never, perhaps, has there been so great a volume of scientific and technical development in any one subject as there has been in synthetic rubber since the last war. The power of research is great and has manifested itself time and again. In these columns are many instances during the past years in which natural products have been superseded by manufactured products. It may well be that the development of synthetic plastics will enable such control to be obtained over properties that the chemical manufacture of elastic plastics will supersede the natural cultivation of rubber. The tendency is for modern man to become a manufacturing animal rather than an agricultural animal, and although great agricultural developments are proposed in many countries that have now been devastated, it seems doubtful how far permanent agricultural industries, apart from food supply, can be regarded as a long-term policy for any country. The chemist is solving many problems—but he is producing many others.

Readers will recall Dr. Stine's recent paper on the development of chemical technology in America to which we referred in our Annual Review number. It is almost impossible to forecast in what direction progress will next be most evident and, if only for that reason, it is imperative that a highly industrialised country like Great Britain should not allow any major chemical development to pass unheeded and without taking sufficient practical steps at least to gain experience of the technique involved. We have no experience, for example, of the Fischer-Tropsch process for producing hydrocarbon oils from carbon monoxide and hydrogen, other than some minor experiments at the Fuel Research Station. We have no industrial-scale experience in the production of synthetic rubber. There is no plant in this country for the liquefaction of coal gas and the production of organic chemicals therefrom. There is no plant in this country for working up gases and by-products from petroleum refineries. There is no Government encouragement of the British chemical plant industry. It is indeed time that as a nation we became chemically minded.

NOTES AND COMMENTS

Industry Fights Unemployment

THOUGH it must have been actually under consideration while the Beveridge Report was being prepared, the important document, "The Problem of Unemployment," issued by Lever Brothers and Unilever, Ltd., last week, supplements rather than duplicates the work of Sir William Beveridge. Only this month the President of the Board of Trade summoned industry to contribute some hard thinking to the unemployment problem, and this, the most important document on the subject sponsored by industry up to date, is a very pertinent answer to his call. Like Sir William Beveridge, the Lever pamphlet offers no nostrums or ideal solutions; it is essentially realistic. Its principal aim is to suggest a method for the abolition of "mass unemployment," without which no scheme for society security can be considered practicable—the premiss that such unemployment can be abolished is, indeed, one of the cardinal assumptions on which the Beveridge Plan is based. The main root of the unemployment problem is stated to be the irregularity of productive activity; and the major irregularities in productive activity are the result of irregularities in the extention of capital equipment. The problem of unemployment depends, therefore, on maintaining regularity in such extensions.

The Government's Part

SELF-IMPOSED discipline on the part of industry can help towards the solution of the problem, but the main task in fostering regular capital investment, and through it regular employment, lies with the Government, by means of the powerful weapon of indirect control. By its monetary and budgetary policy, Government can influence the whole economic structure; by its own expenditure and by taxation it can regulate the ultimate expenditure of the national income. Reversing the fiscal policy of the past, taxation at a higher rate should be imposed in times of prosperity, at a lower rate during a depression. To achieve this without dislocation of normal governmental functions, a system of two Budgets should be introduced: an "ordinary" Budget, balanced annually, for meeting standing expenditure out of current revenue; and an "extraordinary" Budget to meet normal capital expenditure and such emergency measures as might be advisable in times of depression to fight unemployment or stimulate trade. This latter Budget would be covered—or over-covered—only in times of prosperity. Over-production and under-consumption, so long assumed to be a *cause* of unemployment, are thus put in their proper place as *symptoms*. In a depression, it is not merely that the people cannot buy what they want—they cannot sell what they have to offer, *i.e.*, their willingness to work. There is no space here to detail the measures recommended to the Government to achieve the desired end; they will bear reading and re-reading in the original, and everyone interested in the prosperity of British—and not only British—industry should make it his business to study this pamphlet. It is understood that a few spare copies are available on application to the Secretary at Unilever House, London, E.C.4.

Anti-Rust Material

IN connection with the reference in our issue of January 23, 1943, to the work by Canadian scientists on anti-rust material, a correspondent has written us on this subject. He states that the claim of a secret material to withstand salt spray for 500 hours is liable to give a somewhat misleading impression as regards the nature of the achievement. For example, the entirely British product known as "Detel," a special variety of chlorinated rubber, the invention of F. C. Dyche-Teague, will easily withstand 1000 hours of the standard salt spray test. In addition to this, if the steel specimen is scratched, even the exposed part of the metal does not begin to show rust until after more than 500 hours' exposure, the surrounding film of "Detel" having an inhibiting effect. "Detel" was placed on the market in 1931-32 and has been in extensive use for over ten years, particularly in dealing with severe cases of corrosion, of which there are many examples in chemical works and other establishments operating under conditions of exposure to acids and acid gases. Another most important field is the prevention of corrosion of the hulls of steel ships by sea water, and of

plant and equipment exposed to sea air, long recognised as a peculiarly difficult problem. The prevention of corrosion of food containers for long-period storage or for conditions of severe atmospheric exposure is another field of extensive application in connection with the war.

Fuel Efficiency Education

EMBOLDENED by the success of the year's run of its training scheme, the Fuel Efficiency Committee has announced a constructive programme for the future. The original scheme was, admittedly, an emergency scheme, and the committee does not feel that its task is by any means completed. It has been suggested that this scheme may well have far-reaching effects on long-term fuel education policy, and with this in mind the educational sub-committee has been devoting considerable attention to what might be termed the interim period between the emergency scheme and post-war comprehensive training in fuel technology. The committee's investigations and plans may be grouped under the following headings: (a) continuation of the present emergency scheme; (b) fuel efficiency handbook; (c) intensive training courses; (d) a permanent and central staff college. Although 24 colleges have operated the emergency series of lectures at least twice; there are still 38 centres where the course has only been run once, and where there is probably scope for a repetition of the original lectures.

Intensive Training Courses

THE emergency scheme has usually spread the instruction over a period of between six and twelve weeks. The need has been expressed in certain directions for more intensive courses condensed into a period of about a week and embracing practice on the actual operation of various types of steam-raising and steam-using plant. The committee accordingly has under consideration the organising of intensive courses of training in fuel efficiency occupying a full week and embracing not only lectures and discussions, but also demonstrations of various types of plant, including the actual operation of such plant by students. Difficulty will no doubt be experienced in securing the release of industrial personnel to spare a full week for attendance at such centres, but it is estimated that the dividend which an individual firm will receive by increased efficiency from its plant will more than justify the inconvenience of releasing members of its technical staff for a week's training. As a logical development of such an intensive training scheme there would appear to be scope for the establishment of a permanent and central training college for educating lectures, management staff, boilerhouse firemen, and post-graduate fuel technology students in practical fuel efficiency. A permanent installation of carefully selected and interchangeable plant not only for demonstrations, but also for test purposes, would meet a growing need for both instructional and research facilities.

American Comparison

DURING a broadcast to America in the early hours of last Tuesday morning, Sir Miles Thomas, vice-chairman of the Nuffield Organisation, expressed his admiration for the huge American arsenals erected in record time, fitted with the finest modern equipment and capable of prodigious output, which he found upon his recent tour of America. A point from his broadcast which will not have occurred to everybody was the advantage that Americans have in being able to concentrate their plants instead of having to adopt a policy of dispersal such as has been forced on British production engineers as a result of the bombing menace. Sir Miles added, however, that contrary to expectations, the disadvantages of dispersal have been more than discounted by the spirit of the workpeople, so that the production figures for our plants come very close to the production figures that might have been expected had the operatives, whose products have finally to link together, been housed under one roof. There is evidence that certain American machine tools that have been "lease-lent" to us are operating here at better floor-to-floor times than they are in some of the American factories. Another unexpected feature which he stressed was the remarkable adaptability of women in highly technical war industries. Women "have done a magnificent job of engineering, as operatives of machine tools, as welders and as fitters," said Sir Miles; "they seem to have a patience and adaptability that is given to very few men."

Anhydrous Hydrogen Chloride*

Methods of Production Discussed

by A. H. MAUDE

Hooker Electrochemical Company, New York

HYDROGEN chloride† is coming into prominence as an industrial chemical. It can be used for certain reactions when muriatic acid† is unsuitable. Such purposes include the production of vinyl chloride from acetylene, alkyl chlorides from olefines, separating cotton from wool in reworking shoddy, production of arsenious chloride from arsenious oxide, etc. It is also needed for production of liquid anhydrous HCl. There are other reactions where the use of hydrogen chloride is preferable to the use of muriatic acid, such as the preparation of various metallic chlorides from oxides, saccharification of wood, preparation of chlorides from alcohols, and amine hydrochlorides.

The purpose of this paper, therefore, is to discuss the production of pure hydrogen chloride gas by two processes: (1) direct synthesis, (2) concentration from weak or impure gas by means of a dry absorption process.

Direct Synthetic Process

References to the synthesis of hydrogen chloride gas are found as early as 1878, and a survey of the patent and technical literature from that time to the present day, indicates the following among the problems confronting the designer of a synthetic HCl plant: (1) Materials of construction for the burner; (2) materials of construction for the combustion chamber; (3) materials of construction for the cooler; (4) method of proportioning the gases; (5) method of igniting the gases; (6) means for heat removal; (7) safety precautions; (8) general design.

The earlier inventors, who used silica and brick construction for the burners and combustion chambers, appear to have adopted this somewhat unwieldy equipment because of its resistance to moist HCl and to high temperatures. At first sight this might appear logical, since the burner is subject to moist HCl whenever it is shut down and allowed to cool, and to high temperature if not adequately cooled. But it seems more practical when working on a large scale to avoid these conditions than to provide against them.

Combustion Chamber Design

Metal construction for the burner and combustion chamber has definite limitations which can be met by suitable design. First the metal must be kept cool, since the theoretical flame temperature is about 2100° C., which would melt any ordinary metal, while at a much lower temperature the metal is corroded by the HCl or by any impurities in it, such as water or chlorine. Second, the metal must be warm enough to prevent condensation of dew. This "dew" is a saturated solution of HCl in water and forms at a much higher temperature than that at which pure water would condense. With metal construction the dew point is still higher, because the condensate is almost always saturated with the chloride of the metal of which the equipment is constructed. We have found that a third factor, raising the lower limit of the temperature at which corrosion due to aqueous acid occurs, is adsorption of a liquid phase on the metal surface.

The above tends to indicate that almost any common metal can be used within certain temperature ranges, depending on the moisture content of the product, which, in turn, depends on the moisture and oxygen contents of the chlorine and of the hydrogen. The allowable temperature range is influenced by the extent to which the chloride of the metal used tends to be hygroscopic. Thus, iron can be used safely 30° C. above the HCl-H_2O dew point, since ferric chloride is very hygroscopic, but copper may be used only 5° C. above the dew point. For best results a fairly uniform jacket temperature must be employed, which can be attained by a rapidly circulating cool-

* From a paper presented to the American Institute of Chemical Engineers (*Chem. Ind.*, 1942, **51**, 3, p. 348).

† Throughout this paper the term "hydrogen chloride" signifies the anhydrous gas, as distinguished from the aqueous solutions called "muriatic acid."

ing medium. The apparatus must also be so designed that every part of the metal is jacketed by this medium to prevent any spot from reaching a temperature high enough or low enough to cause corrosion. Choice of the material of construction for the cooler is more difficult if the gas must be cooled to a temperature below the dew point. In this event the gas must pass to some non-metallic material, such as glass, stoneware, impregnated graphite, or silica, although tantalum may be used.

The problem of gas proportioning is a purely mechanical one and will not be discussed here beyond mentioning the grave consequence of a producing system swinging over from excess hydrogen to excess chlorine. If this happens and the gas is being used in an absorber or some chemical reactor consuming the HCl only, we are left with an atmosphere of chlorine plus hydrogen (left from HCl gas preceding the change) which is spontaneously explosive.

Ignition Methods

Igniting the gases in the burner may appear a very simple matter to those who have not worked on this problem. In practice, it occasions some difficulties. The literature describes igniting the mixture by means of a burning oily rag, an electric spark, or a strong light. None of these methods is entirely satisfactory. A burning rag is extinguished in an inert atmosphere, as of hydrogen chloride. An electric sparking device is destroyed by the high flame temperature, and electrical connections are troublesome in the vicinity of HCl fumes which so readily condense a highly conductive dew. Our own experience with a light has been quite unsatisfactory, although others report it to be dependable. Of the alternatives that have been suggested, perhaps the most practical is the use of a retractable blow-torch, providing an air-hydrogen flame. Such a flame will persist when plunged into an inert atmosphere and is a positive method of ignition. Some care is required in design to ensure a flame perfectly persistent both in the air when first lit and in the inert gases in the combustion chamber, as well as during the period while it is forced into the combustion chamber through a well-fitting gland. The other alternative involves the use of some material that spontaneously inflames in chlorine. The choice of material is not quite so easy as it appears at first sight. A powder cannot be used as it cannot be conveniently supported in the gas stream. A great many materials, stated in the literature to be spontaneously inflammable in chlorine gas, fail in practice, as they do not work in a rapid stream of chlorine or in a mixture of chlorine and HCl. It is highly important that the operator ignites the gas as soon as it enters the combustion chamber and does not let an explosive mixture accumulate.

It is necessary to remove heat from the wall of the combustion chamber to avoid overheating to the extent of damaging it. It is also generally necessary to cool the gas before it can be utilised. Heat is satisfactorily removed from the combustion chamber by a warm water jacket in which the water circulates to avoid cold spots where dew could condense. Heat can also be removed without any jacket by radiation, but then much more surface is needed, particularly as the metal close to the flame generally needs protection from an excessive temperature by a brick lining.

Equipment Protection

It has been said that all synthetic HCl plants blow up sooner or later. This is probably true. An operator will be careless, or some unforeseen event will occur. It is therefore necessary to protect the equipment by a variety of safety devices. Hydrogen and chlorine are said not to explode in the dark. In clean glass tubes of small diameter they do not. In large, plant-size, metal vessels they do. In unglazed ceramic vessels they do. We have sometimes considered it absolutely necessary to construct the apparatus in such a way that no serious harm is done if an explosion does take place. This means provision of a large frangible disc close to, and in a straight line with, the normal location of the flame. After many experiments, a suitable diaphragm was worked out. Another necessary precaution is a device to prevent an explosive mixture from being delivered in place of hydrogen chloride. This consists of an ignition device in the combustion chamber or in the outlet pipe. Such a device may consist of an electrically heated resistance wire in a silica tube.

Failure of either the chlorine or hydro-

gen gas supply, or of cooling water, must be anticipated. If suitable precautions are not taken, one gas might fail, extinguishing the flame, and then start flowing again to form an explosive mixture. An emergency system has now been worked out which will do the following jobs automatically and independently of an electric, air, or other service line.

If the hydrogen supply fails: (1) The chlorine feed is cut off; (2) if hydrogen supply is resumed, neither it nor the chlorine can re-enter the system until the operator has taken certain steps; (3) partial vacuum resulting from sudden extinction of the flame is prevented in order to avoid a suck-back of gas from point of use into the burner.

If the chlorine supply fails: (1) The hydrogen is cut off before all the chlorine in the equipment is consumed, so that the system cannot be charged with potentially hazardous hydrogen; (2) if the chlorine supply is resumed, it cannot enter the burner, nor can the hydrogen enter the burner until attended to; (3) partial vacuum resulting from the flame extinction is dealt with as above.

A very important precaution is to provide the combustion chamber with a liquid seal which will blow at a lower pressure than that of the hydrogen supply or of the chlorine supply, in order to be absolutely certain that neither gas can flow back into the line delivering the other gas, as this might lead to a particularly dangerous condition.

In the event of failure of cooling water, there is danger of burning up the equipment rather quickly. Therefore a no-pressure alarm can be installed on the water line, or an emergency water storage reservoir may be provided. In many cases it is necessary to provide for the sudden closing off of the HCl delivery pipe. This can be done by means of the above-mentioned liquid seal.

One further precaution, which may appear excessive, but is certainly justified in some installations, consists of connections to permit blowing out the entire combustion chamber with CO_2. The CO_2 atmosphere is entirely safe, whereas purging with air or chlorine leads to a potentially explosive atmosphere in the event of the presence of hydrogen. Purging with hydrogen leads to a potential hazard in the event of in-leakage of chlorine or air. Purging with chlorine, furthermore, creates discomfort for the operators when the apparatus is opened.

General Design

The general design involves features to accomplish the aims set forth. In addition, it is necessary to provide accessories as sight glasses, connections for purging with inert gas, connections for draining out any condensate inadvertently formed, manometers, thermometers, and so on. If purer hydrogen chloride is desired, an automatic analyser may be used which automatically adjusts

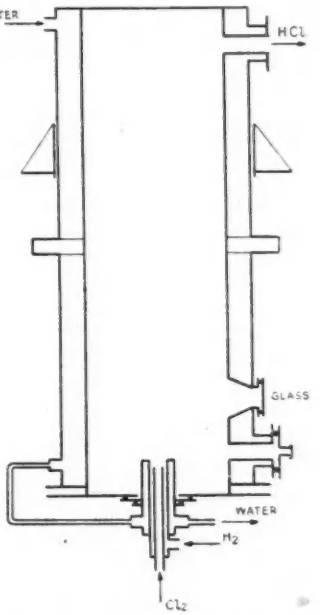


Diagram of hydrogen-chlorine burner

the gas flow. A pilot plant which has been in operation with such a scheme shows an analysis of gas held at 99.0 to 99.5 per cent. when using evaporated liquid chlorine. Hydrogen chloride made by this method containing less than 0.5 per cent. excess hydrogen, has detectable traces of chlorine in it.

The impurities present in small amounts in the hydrogen are nitrogen, oxygen and moisture. In the chlorine there may be nitrogen, oxygen, hydrogen,

and carbon dioxide. If "blow gas" chlorine‡ is used, the impurities may amount to 50 per cent. of the gas by volume. Moisture may be removed from the product by a drier, or fairly well by adequate cooling. The moisture remaining in the cooled gas is very slight. Any oxygen present in the feed gases is converted to moisture during combustion. Carbon dioxide is reduced to some extent to carbon monoxide. Thus, synthetic hydrogen chloride made from typical evaporated liquid chlorine and electrolytic hydrogen analyses as follows: hydrogen chloride, 99.00 (volume per cent.); chlorine, none; hydrogen, 0.64; nitrogen, 0.20; water vapour, 0.10; carbon dioxide, 0.05; carbon monoxide, 0.01. The gas also contains 0.002 per cent. by weight of ferric chloride if iron construction is used.

If a copper combustion chamber is used, there is no iron and less than one part of copper per million. The product is necessarily free of arsenic and sulphur compounds, and if absorbed in distilled water, yields an analytical reagent grade of muriatic acid. The relation of the free chlorine to the free hydrogen in the product depends on design and output of burner and combustion chamber.

Alternative Processes

To discuss the place of the synthetic process for hydrogen chloride in industry, it is desirable to review alternative processes. Commercially possible reactions fall into the following classification: (a) acid plus a metallic chloride, (b) chlorine plus organic substances, (c) chlorine plus ammonia, (d) chlorine plus water, (e) water plus sulphur dioxide and chlorine, (f) hydrogen plus metallic chlorides, (g) metallic chlorides plus water.

(a) *Acid plus a Metallic Chloride.*—Undoubtedly the process for hydrogen chloride most widely used in industry to-day is still the common salt-sulphuric acid reaction. This reaction may be carried to completion, producing salt cake, or halfway to the bisulphate state only. Thus:

$$NaCl + H_2SO_4 = NaHSO_4 + HCl$$

This reaction can be conducted in a closed retort and a fairly pure hydrogen chloride gas can be obtained. However, sodium bisulphate has only limited uses; it can be further reacted with salt in a salt coke furnace, thus:

$$NaHSO_4 + NaCl = Na_2SO_4 + HCl$$

yielding more HCl and salt cake. But this second step in commercial forms of apparatus yields dilute HCl gas. If the reaction is carried only to the bisulphate stage, the principal limitations are: (1) by-product bisulphate needs further processing before it is marketable, (2) twice the theoretical quantity of sulphuric acid is used, and (3) hydrogen chloride produced is contaminated with sulphuric acid, and (4) other impurities may come from the sulphuric acid used.

Reaction Completion in One Stage

When the process is carried on to completion in one stage, the gas may be as dilute as 60 per cent., and thus need concentration. As all industrial chlorine derivatives originate ultimately from sodium chloride, with the somewhat minor exceptions of KCl for caustic potash and $MgCl_2$ for Mg, the use of other chlorides could only be justified if they are by-products of little value. Calcium chloride is such a by-product, but as the calcium sulphate obtained has no value, its reaction with sulphuric acid is not economical. One suggestion, which under some conditions might be useful, is the reaction with sulphuric acid of ferrous chloride originating from muriatic acid steel pickling. In this case, the resulting ferrous sulphate has commercial value.

(b) *Chlorine plus Organic Substances.* Large amounts of HCl are produced as by-product of the chlorination of organic substances, notably the low-molecular-weight paraffin hydrocarbons, and the simpler aromatic compounds such as benzene, toluene, and naphthalene. The gas produced is normally contaminated with organic products, chlorine, and air, less often with moisture. Such by-product is often not well located or synchronised with respect to the demand for HCl gas. Aliphatic hydrocarbons can be chlorinated with pyrolysis to yield HCl and carbon, but the product is contaminated with carbon, organic matter, and sometimes with chlorine. The purification problem is quite serious, but may be met by the dry absorption system.

(c) *Chlorine plus Ammonia.*—We must not ignore the process of reacting

‡ Non-condensables saturated with chlorine at the pressure and temperature of the liquefaction process.

chlorine with ammonia at a high temperature. The result is somewhat diluted gas (85.7 per cent. HCl). The reaction is: $2NH_3 + 3Cl_2 = 6HCl + N_2$. But as the diluent is only nitrogen, the gas is usable for many purposes. The special utility of this process is for generation of the gas at locations remote from a source of hydrogen. Both chlorine and ammonia may be shipped as liquids in tank cars, but to ship hydrogen in quantity is impractical. The reaction takes place spontaneously and completely, but great care must be taken to avoid mixing the gases at a temperature so low that explosive nitrogen trichloride can form.

(d) *Chlorine plus Water.*—The action of chlorine on water to yield HCl is the inverse of the Deacon process for chlorine from HCl. To obtain complete and rapid reaction by supplying heat and avoiding an equilibrium condition while chlorine is still present, the reaction is carried on with the aid of carbon at red heat, the carbon continuously combining with the oxygen liberated. The HCl produced is contaminated with oxides of carbon, water vapour, sulphur compounds from the coke used, and in general is not suitable for processes needing a high-grade gas.

(e) *Water plus Sulphur Dioxide and Chlorine.* — An interesting proposed method consists of reacting SO_2 and Cl_2 in the presence of moisture. Welch reports that this reaction can be brought about to produce sulphuric acid up to 95 per cent. concentration and HCl gas. In a similar process, the SO_2 and Cl_2 are first combined to make sulphuryl chloride which is later decomposed by steam. The particular merit of this modification is that the sulphuryl chloride can readily be stored and shipped, then decomposed when required. In view of the difficulties of storing SO_2, Cl_2, or HCl gas, this process may be recommended.

Concentration Methods

Distillation of Muriatic Acid.—The principal commercial method, to-day, of concentrating HCl is to absorb it in water to obtain a concentrated solution, which is distilled until a constant boiling mixture (20 per cent. HCl) is approached. The vapours are cooled and moisture condensed from them. This condensate and the liquid in the still are cooled and again saturated with HCl gas. The gas is finally dried by sulphuric acid. The difficulties of this process lie in materials for construction. In general, non-metallic materials are used, though tantalum is quite suitable, for the steam tubes to vaporise the acid. Material for other parts of the equipment may be ceramic, impregnated carbon or impregnated graphite, glass, and, where not subjected to temperatures above 90-100° C., rubber or one of the synthetic rubbers. Although all the problems are believed to have been solved, the difficulty inherent in the materials of construction must not be minimised, particularly if the apparatus is operated much above atmospheric pressure.

Desorption from Addition Compound. An alternative commercial method of concentration does not involve the use of aqueous solutions and may be conducted entirely in iron apparatus, provided the gas is dry to start with. This method consists in absorbing the gas by a metallic salt capable of retaining HCl in a manner analogous to the addition of water of crystallisation by some anhydrous salts. The compound may then be heated to desorb or "strip" pure hydrogen chloride from the non-volatile salt, and the latter used again to repeat the cycle indefinitely.

Ephraim's Contribution

A substantial contribution to the knowledge of compounds capable of evolving HCl by heat was made by Ephraim (*Ber.* 1925, *58*, 2262; 1926 *59*, 790; 1928, *61*, 2161). He found that not only could lead sulphate and copper sulphate be used, but also the sulphates of cadmium, silver, mercury, tin, bismuth, antimony, and thallium, also certain phosphates and phosphites. In each case he determined the composition of the product and in most cases the temperature of evolution of hydrogen chloride. In the case of the copper sulphate compound with hydrogen chloride, he found that 1·5 moles of HCl are lost at 83° C., but that ¼ mole is retained at 100° C. In the case of lead sulphate, he also found that $PbSO_4.2HCl$ was formed. One and a half molecules of HCl are lost at 32° C. The balance is not completely removed, even at 100°.

Although the hydrochloride of copper sulphate has been described as readily produced by the action of HCl gas on the anhydrous salt, this does not seem to

be universally true, since some samples of anhydrous copper sulphate are found to absorb HCl only extremely slowly and incompletely. Among the factors influencing the rate of absorption, the most important is the temperature at which the salt is dehydrated. The product is a brown powder instantly decomposed by water. In appearance and feel it is slightly moist, which has led to the conclusion that it contains free H_2SO_4. The empirical formula, $CuCl_2.H_2SO_4$, is identical with that of $CuSO_4.2HCl$. It is probable that this powder contains a small amount of the former composition. The compound is decomposed by gentle heat to HCl and $CuSO_4$. The heat of absorption of HCl by $CuSO_4$ is very large, approximating the heat of solution of HCl in water. As the temperature of the compound is raised, the vapour pressure of HCl increases. We have been unable to regard this pressure as a constant and fixed property of a definite chemical compound. The pressure of HCl decreases gradually as desorption proceeds under isothermal conditions. A temperature of 130° C. is needed to obtain desorption at atmospheric pressure, but it was found that initially a vapour pressure of one atmosphere is attained at 90° C.

Suitable Absorbent Found

For practical reasons it is expedient to disperse the compound over a carrier, since the gas cannot be passed through the powder in any convenient commercial apparatus. One possible method of handling the material is to mix it with some clay or clay-like material and then dehydrate the clay and copper sulphate together by baking. Various other absorbent materials may be used, observing the principle that for practical plant design, it is very important to obtain the maximum amount of copper sulphate in the minimum volume. The cost of the plant is much influenced by the volume of absorbent used and by the amount of heat-transfer surface provided. After many trials, an absorbent has been found which offers negligible resistance to gas flow, absorbs 14 lb. of HCl per cubic foot, and does not deteriorate on repeated re-use. It is sufficiently strong to be handled and not to disintegrate in use. This mass requires neither refrigeration, nor temperatures in excess of those obtainable by steam at usual pressures.

In the course of the investigation, a great deal of trouble was encountered by deterioration of absorptive capacity. In some instances when clay was used, there appeared to be a metathetical reaction between aluminium silicate and copper sulphate. Another hypothesis is that H_2SO_4 is always formed and in some cases seeps away from the copper salt. If copper sulphate-hydrochloride can dissociate to a slight extent to copper chloride and H_2SO_4, this reaction might reverse itself at higher temperatures if the H_2SO_4 remained where liberated. But if its micro distribution were changed, the reverse reaction could not occur to completion. Volatile organic substances such as issue from hydrocarbon chlorinators appear to be without influence on this process. As the absorption proceeds at temperatures up to 70° C., the volatile impurities pass through unabsorbed. Moisture is detrimental and a preliminary drying of the gas is sometimes necessary. Dilution of the gas markedly slows down the rate of absorption. The system works very satisfactorily with gases containing 50 per cent. HCl or more, but it is very doubtful whether the plant would prove economical for the concentration of gases initially below about 25 per cent. HCl. Furthermore, it appears to be commercially impracticable to absorb the HCl completely by this method, and consequently small quantities, say, from 1 to 5 per cent., are allowed to pass through unabsorbed, but may, if justified economically, be caught in a water scrubber as muriatic acid.

The design of a plant varies greatly according to the practical conditions under which it is to operate. Such factors as concentration of the HCl fed to the system, the steam pressure available, the pressure on the raw gases, and the pressure desired on the purified gas, which may be two or three atmospheres or even higher, affect the design of the plant to an extraordinary extent. The actual plant is simple and takes the form of a shell and tube vessel to hold the mass. This is cooled by water during a six-hour absorption cycle and heated by steam during a three-hour desorption cycle.

Sodium Metaphosphate

Its Use in the Textile Industry

by H. SEYMOUR

METAPHOSPHORIC acid and its salts were discovered over a century ago, though it was not until 1929 that their value in industry was demonstrated by R. E. Hall. He showed that the addition of sodium metaphosphate in excess concentrations governed by the calcium and magnesium content of the boiler-feed water prevented formation of calcium phosphate precipitates in the feed pipes of a boiler; and further, that if calcium phosphate or carbonate deposits already existed in those pipes, the use of the same proportions of sodium metaphosphate resulted in a gradual dissolution of the deposits until they were removed completely. Hall also discovered that sodium metaphosphate acted on calcium and magnesium soaps in alkaline solutions in the same manner as it acted on inorganic precipitates of those metals. In other words, water could be softened to soap by the use of the metaphosphate without producing any precipitate whatever. Water could, in fact, be so softened that the addition of calcium and magnesium would not destroy its softness. Furthermore, soap precipitates already formed could be re-dissolved in alkaline solutions with regeneration of sodium soaps in a form able to enter into action as new soap. In non-technical language, the metaphosphate has the power of "locking-up" calcium compounds and other hardness-forming constituents of water, so that they cannot react in the usual way with soap, and so that deposits of calcium compounds, already present, will dissolve.

Calcium Deposits Removed

It was not long before this property of sodium metaphosphate was employed in the textile industries. For example, textile fibres at certain stages of manufacture are commonly contaminated with superficial deposits of insoluble calcium salts. These cause difficulty in bleaching and dyeing. Sodium metaphosphate has been found to remove these deposits. Further, it is well known that in the laundering of clothes calcium soaps are deposited, which results in the "greying" of white goods, and in lack of brilliance in coloured ones. These deposits are inhibited by the addition of metaphosphate to the wash liquors, or, if they are already present in the clothes, are removed in the presence of metaphosphate, with the liberation of sodium soap and the production of a lather.

It is possible to prepare several forms of sodium metaphosphate, which have varying properties, one form being extremely soluble in water, while another is insoluble in water. The best known of the soluble forms is sodium hexametaphosphate $(NaPO_3)_6$, and this salt is employed as the main constituent of a product known as Calgon and utilised in the textile industries. Calgon takes the form of colourless glass-like plates about one inch across and 1/16 in. thick. This product is generally made up as a 25 per cent. stock solution and added as necessary to the working liquors. In making up the solution, the bags are suspended in a wooden or earthenware vessel, with the requisite amount of warm water. Metallic containers should not be used for this purpose, nor should the water be above about 38° C. The *p*H of a dilute solution of Calgon is about 7.2. When used in conjunction with soap it is usually necessary to render the solution more alkaline, and sodium carbonate may be added for this purpose.

American Advances

While this product has been used successfully over here by laundries and textile works, considerably more experience has been gained with it in America. Recently, C. J. Munter and E. B. Bell described the results of some studies on the effects of sodium metaphosphate on various textile operations at a meeting of the American Association of Textile Chemists and Colourists. For example, when introduced into the kier liquor to the extent of 0.25 per cent. of the weight of the goods, sodium metaphosphate produced a marked visible improvement in the kier-boils at one works. The improvement showed itself first in the better colour of the cotton at the kier, using the colour obtained in the regular kiering process as a basis for comparison. In the second place, less scum and sludge than were usually present were reported. While these improvements indicated a better kier-boil, the full value of the change produced was not appreciated until it was found that the jig-dyeing troubles were for all practical purposes eliminated, and it was possible to turn out satisfactory work where before much of it had to be reprocessed before it could be accepted.

While a good kier-boiling may be expected to prepare the cloth so that satisfactory results will be obtained in the bleaching operation following kiering, in some cases trouble arises in the bleaching and connected operations, these troubles not being traceable to kier-boiling in any way. As is well known, the use of sulphuric acid for souring after calcium hypochlorite bleach-

ing produces in the goods spots of calcium sulphate which subsequently give trouble in dyeing. Generally, these spots are prevented by the use of hydrochloric acid, whose calcium salt is soluble, but the change involves increased costs due to difference in acid costs. In one works studied by Munter and Bell this difficulty was experienced in the dyeing of cotton warps that had been bleached with calcium hypochlorite, soured in sulphuric acid, rinsed and scoured. The resistant spots produced specks and cloudy effects in the dyed material. As indicated above, to overcome the trouble the plant was forced to use hydrochloric acid in souring all work to be dyed, though on white work sulphuric acid was used without trouble. Because of occasional dyeing troubles, even after the use of hydrochloric acid, sodium metaphosphate was introduced into the scouring operation preceding dyeing in amounts equal to twice the quantity required to soften the water of the scouring bath. This recommended procedure was based on the observation that the remaining troubles encountered in dyeing appeared to be solely the result of deposits formed in the scouring operation. The modification having corrected the remaining dyeing troubles, the works wished to make an attempt to return to the sulphuric acid sour, in the hope that the sodium metaphosphate would remove the resistant spots formed by the sulphuric acid sour. Practice quickly demonstrated that it was possible to use the cheaper acid for souring after the bleach on all classes of work without recurrence of the dyeing trouble.

Scum Accumulation

In one dyehouse where naphthol colours were being applied to chain warps, scum accumulations on the naphthol bath were consistently giving trouble. This scum attached itself to the material as it passed through the first bath and carried on through the whole dyeing process, with the result that the finished warps crocked severely, besides smudging badly wherever the scum was attached. The introduction of sodium metaphosphate, in amounts slightly in excess of the requirement for softening the water of the first bath, eliminated the scum formation. Not only did it correct the condition of the dyed goods with respect to smudginess, but this treatment reduced the crocking to a great extent, thus showing the crocking trouble to be closely connected with the formation of the scum. Penetration of the dyestuff was also improved. At this works it was found that the sodium metaphosphate solution gave trouble if introduced, either directly or by carry-over on the warps, in too large amounts into the second bath. To overcome this trouble it was found best to keep the sodium metaphosphate dosage in the first bath as low as consistent with scum prevention, whereupon the amounts unavoidably carried over were insufficient to give trouble. As a slight excess over the softening requirement was sufficient to assure this, no further trouble occurred in the dyeing. Trouble of this type, however, is not universal, as in some cases the metaphosphate is not detrimental but apparently beneficial in the second bath.

Removal of Mineral Oil

In another instance worsted-mill waste and garment-factory floor waste containing large amounts of mineral oil were being stock-dyed black and navy blue in pressure machines, the material to be used in woollen mixtures. Before dyeing, the stock was always boiled-off with ammonia and soluble oil. This treatment apparently did not remove all the mineral oil, since after dyeing with direct cotton colours and neutral dyeing union colours with salt in the liquor, the stock contained many undyed specks and unpenetrated knots, and in many instances remained actually oily. The introduction of sodium metaphosphate into these dyeing operations, in amounts approximately double the water-softening requirements, produced some very marked effects. The dyed goods were freed of the oil which scouring had failed to remove; the cotton dyed deeper than in any previous dyeings on this type of stock; and better penetration was obtained, the knots being uniformly penetrated and specks being absent.

The advantages of sodium metaphosphate in the dyeing of cotton thus far discussed have been related to the prevention of scums and other deposits by the hardness of the water used in the dyeing baths and to the removal of undesirable materials, such as oil, from the fabrics. In addition to these actions, an important effect on the dyestuffs themselves has been frequently observed by Munter and Bell in practice. This has to do with the solubility of dyestuffs. The general observations in this respect have been to the effect that direct and sulphur dyestuffs, and in one case mordant acid dyestuffs, have been made more soluble by the sodium metaphosphate, the effect in the case of sulphur dyes being noticeable in the preparation of the dyes for use.

In one vat-dyeing process cotton cloth was being washed in rope form in a boiling soap bath at the completion of the dyeing steps. This operation served to make the colours faster and to brighten them by removing all unfixed dyestuff. However, because of materials carried into the bath on the goods and on account of the hardness of the water, difficulty was experienced in keeping the soaping bath effective in its action. On the addition of sodium metaphosphate less trouble was experienced in this respect and the life of the bath was

markedly prolonged. In another case a hot neutral soap bath, in which alkali could not be used, gave consistent trouble from scum and from failure to function during operation. The scum formation was particularly irksome as it carried on with the cloth to form smudges and spots. By adding sodium metaphosphate in sufficient quantities to keep the bath soft at all times, scum was eliminated and the bath life lengthened, so that operations could be carried to completion without interruptions.

Another interesting application of sodium metaphosphate has been found in connection with the scouring of raw wool. In dealing with a four-bowl tray for scouring fleece wool, it was found that soap and alkali were being used in three of the four bowls, the last bowl serving for rinsing. Because of the softness of the water in use, it was impossible to save significant amounts of soap and alkali by using metaphosphate in all soap and alkali bowls. It was considered desirable, therefore, to discontinue the soap and alkali in No. 3 bowl in the expectation that the amount of those materials carried by the wool into the water of No. 3 bowl, thoroughly softened by sodium metaphosphate, would continue their action in that bowl since they could not be precipitated there by hard water. Furthermore, by reason of the dilution of the soap and alkali in No. 3 bowl, rinsing would really be started at that point. At the start of operations sufficient metaphosphate was, therefore, added to soften the water in this bowl, and during the run additional metaphosphate was added as was necessary to keep the water soft. To No. 1 and 2 bowls the usual amounts of soap and alkali were added at the start, the operators adding the usual dosages during the run; to No. 4 bowl nothing was added. After working on the above basis at the usual production rate, the wool produced had a better colour, odour, and feel than the usual stock.

Petroleum Resins*

A Note on American Development

UNSATURATED hydrocarbons, so abundant in the United States as the result of enormous cracking operations of petroleum, have long been visualised as an inexpensive and readily available raw material for the manufacture of synthetic resins. Research in the U.S. has been active in this field since 1928. Those connected with the development of synthetic resins and resinoids from petroleum soon realised the desirability of having a controlled raw material. The production of uniformly unsaturated hydrocarbons from a heterogeneous cracked distillate presented many difficulties, and the preparation of commercial resins from a petroleum source at an attractive cost was not easy.

Distillers obtained from cracking a low-molecular-weight hydrocarbon, such as propane, butane, etc., which at high temperatures and low pressures have a high degree of unsaturation and offer one of the best sources of reactive hydrocarbons. It was found that resultant distillates are for the most part a mixture of olefines, diolefines, and aromatics, mainly substituted aromatics. The amounts of each constituent depend on the conditions of the cracking operation. When anhydrous aluminium chloride is added to such a distillate under controlled operation, a combination of chemical reactions such as condensation and polymerisation takes place, resulting in a resin which is hard and amber-coloured, and melts at about 100° C. Many types of resins or resinoids can be produced, according to the proportion of diolefines, olefines, and aromatics maintained in the distillate. These resins are still quite unsaturated and are, therefore, reactive with various other compounds. They oxidise readily when exposed in a thin film, and this property accelerates the gelation of varnish oils. These resins can be combined with drying or semi-drying oils for special purposes or used directly in a varnish kettle for producing quick-drying varnishes.

Alternative Catalysts

Other catalysts, such as sulphuric acid, activated clays, and boron trifluoride, may be employed. The resulting product varies according to the catalyst used. Several companies produce petroleum resins of these various types and their main outlet is in the paint and varnish industry. They are, however, finding uses in other fields, as constituents of printing ink, plastic tile, linoleum, laminates, and impregnated fibres.

The tendency in the past few years has been to employ pure or special mixtures of hydrocarbons to produce a certain resin. Ethylene itself can be polymerised under high pressure to produce a rubbery product reported as having excellent electrical properties. Another hydrocarbon, isobutylene, when polymerised at temperatures below 0° C., with boron trifluoride as a catalyst, produces a substance very similar in appearance to rubber. Such polymers are added to lubricating oils to improve their viscosity index characteristics. When isobutylene is copolymerised with a small quantity of a diolefine, a synthetic rubber is produced which may become more important in the near future. Styrene itself, which is being manufactured in increasingly large amounts in America as a constituent for synthetic rubber, is truly a petroleum resin. Both ethylene and benzene, raw materials for styrene, can be produced from petroleum. Styrene is also found when low-molecular-weight hydrocarbons are pyrolysed.

* From an article by C. A. Thomas, of the Monsanto Chemical Company, in *Chem. & Eng. News*, November 25, 1942, p. 1507.

The Efficient Use of Fuel

Committee's Suggestions for Economies in Plant

IT has been emphasised in the past few months, and rightly so, that the maximum economy in the use of all fuels—coal, gas, electricity, and oil—is essential if the industrial output of the country is to be maintained. Managing directors have been asked to do everything in their power to save fuel, and to assist in these efforts the Mines Department have indicated in their many bulletins the broad lines upon which economies might be effected. Investigations into economy measures should not only relate to the actual production of steam but to its efficient utilisation for any process for which it is used.

The view is held by the Fuel Efficiency Committee that substantial savings in fuel might permanently be obtained, to the great advantage of the industries themselves, if attention were focussed on the more efficient utilisation of steam in various types of process work. From the economic point of view, the production of steam is now so costly that it becomes imperative for industry to see that its fuel, steam, power and heat are utilised with the utmost efficiency.

The Committee, through its chairman, states that investigation of plant efficiency and fuel economy should not be deferred on the grounds that new equipment is not easily obtained; it is not unlikely that substantial savings can be made without any addition to existing installations. An example as to what can be achieved is illustrated by a large sugar refinery which carried through a detailed investigation of every stage of its production, with a consequent saving in coal for steam production of 30,000 tons per annum.

Condensate Removal

Correct methods of condensate and air removal are stressed in one of the committee's early bulletins, issued to offer guidance on fuel efficiency and economy in industry. It points out that drain cocks or valves are the obvious way to remove condensate from steam mains, steam power plant, and steam-heating and process plant, but they are just as obviously wasters of fuel. To be efficient the cock or valve must be regulated manually at the rate at which condensate is forming and the pressure in the plant is varying. Under the best conditions, with an operator standing by every minute of the day, such close control is a practical impossibility. Without that close control of the cock or valve, one of two things must happen: either condensate will be held back (to the detriment of plant efficiency) or steam will escape; depending on the condensation rate, pressure, and amount of valve opening at any given moment.

The method of discharging condensate now almost universally used is an automatic self-adjusting valve, known as a steam trap, technical details concerning the various patterns of which were treated in THE CHEMICAL AGE on December 12 last. Its function is to give automatic control of discharge without loss of live steam. Thus it is able to differentiate between steam and condensate. There are a number of types in each of two main groups of steam traps: (1) *Thermostatic*, a type which differentiates between steam and condensate by temperature difference which operates a thermostatic element carrying a valve; (2) *Mechanical*, a type which differentiates between steam and condensate mechanically, generally by the action of a float or a "bucket."

Steam Trap Types

Careful thought should be given to the type and capacity of steam trap to be used and the position in which it is to be fitted. These are factors which have an important bearing on the improvements in plant efficiency and extent of fuel economy which may be obtained. On the question of steam trap type, it is not correct to assume that any one type of steam trap will be suitable for all installations. Each of the many types and patterns has its specific purpose; each has disadvantages as well as advantages.

Traps of the thermostatic group—Balanced Pressure type—are small in size but large in condensate-handling capacity. Generally there are two patterns, one operating at some degrees below steam temperature and the other at nearly steam temperature. Traps of the first pattern are economical in steam, *i.e.*, the temperature of the condensate which they discharge is low. The other pattern, *i.e.*, the one which operates at nearly steam temperature, is preferable when the first consideration is to discharge condensate just as soon as it forms. Generally, the Balanced Pressure Thermostatic trap is easy to maintain; the thermostatic element and valve seat are easily detachable and a new element and seat can be fitted in a matter of minutes without the trap being taken from the line. The thermostatic element of a Balanced Pressure trap is made of a flexible material and is liable to damage by water-hammer or by condensate which contains corrosive substances, and, therefore, this steam trap should not be used under

either of these conditions. If superheat is present it is never safe to use the Balanced Pressure trap.

The Liquid Expansion Thermostatic trap can be used on superheated steam and on higher pressures (within the pressure range of the individual pattern). It is a trap of the continuous discharge type and is not affected by vibration, steam pressure pulsation, or water-hammer. Sometimes it may be necessary, though only rarely, to provide a by-pass to help it in coping with severe load variations. The flexible tubing of the packless gland in this type can be destroyed by condensate containing corrosive substances.

The principle of operation of the Metallic Expansion type of thermostatic trap is very similar to that of the liquid filled type, but the traps are not generally considered as flexible.

Mechanical Types

In the mechanical group, the Float type is not affected by wide and constant fluctuation of pressure, and the working parts can be reached without taking the trap out of line. It is an ideal trap for draining units where the rate of heat transfer is high for the heating surface available. As it discharges condensate at steam pressure it may give rise to re-evaporation at the outlet, though this is not always regarded as a disadvantage. The ball float can be damaged by water-hammer or corrosive condensate. It is necessary to have different sized valve seats for different pressures, so they are not self-adjusting to all pressures up to the maximum as are Balanced Pressure Thermostatic traps. Float traps without thermostatic air vents may need to incorporate a manually operated valve to obviate air binding on starting up. This may lead to a potential source of steam wastage, according to the design.

The Open-Top Bucket type traps in the mechanical group are robust traps which can be used on very high pressures and for superheated steam, but as the type makes no provision for air venting it is liable to air-bind. The Inverted Bucket type in the mechanical group has advantages, but it is wasteful of steam if not chosen exactly for the work to be done.

Trap Capacity

Before deciding on the size of trap to be used on any job one must know the amount of condensate to be handled and then choose a trap of the correct type and capacity. The pattern chosen must have the correct capacity for the peak load of condensate. A too small capacity will result in condensate being held back longer than it should; while a trap with too large a capacity will generally result in waste. The size of the trap body has nothing whatever to do with the capacity of a steam trap, neither have the diameters of inlet and outlet connections anything to do with discharge capacity. The capacity of a trap is governed by differential pressure, the size of the discharge orifice, and temperature of condensate. The chosen trap must be capable of handling the peak load of condensate and generally this will occur during the starting-up period.

The next item to consider is the vessel on which the trap is fitted. Adequate drainage of steam mains and branch lines is essential, and the obvious points are places where condensate can most easily collect. With steam-heated equipment the classes to be considered are (a) those from which condensate must be discharged as quickly as it forms, and (b) those which can make good use of some of the sensible heat in the condensate before the water is discharged. With most types of equipment there is a ready-made drainage point, and from that point condensate should be able to flow freely into the steam trap.

There are a number of causes of sluggish discharge of condensate, such as steam locking (a steam trapping trouble), air binding, dirt, corrosion, frost, water-hammer, and air in steam spaces and these all need looking into in order to get full fuel efficiency.

Best Use of Condensate

On this question the committee state that when considering fuel for industrial purposes one must not overlook the fact that it is more a question of heat supply than of coal supply. There is bound to be some unavoidable wastage of heat but, having allowed this comparatively small loss, it is up to all to see that the rest of the heat allowance is put to good work. It is not a question of better generation of heat from the fuel supply but with the better use of that heat in the form of steam or hot water.

The best place for hot water discharged from steam-using plant is the boiler feed tank or hotwell. The closer to steam temperature at which feed water can be supplied to the boiler the less heat the fuel will have to supply to generate steam. In the condensate discharged from steam plant there is a supply of water at a higher temperature than main water or other cold feed and, by returning it to the tank and feeding it to the boiler, fuel is saved, and feed water and feed-water treatment made up. If there is no feed-water treatment scaling is reduced with a consequent reduction of fuel consumption. Many users hesitate to return condensate to the boiler plant because the water would have to be carried fairly long distances, but the possibility of returning the condensate should

not be ruled out without going carefully into the cost of a return system and comparing it with actual savings to be made. Where the installation cost seems prohibitive, consideration should be given to the possibility of using the hot condensate for purposes other than as boiler feed.

Return Lines

Wherever possible, condensate return lines should have a slight fall in the direction of flow (about 1/16 in. per foot will do). Where condensate must be raised to a higher level it is the pressure at the steam trap and not the trap itself which will raise it. On all installations where condensate has to be raised, efficiency depends to a large extent on the steam trapping arrangements; but it makes no difference to the maximum lifting power whether a steam trap is fitted at the bottom of a rising pipe or at the top. It is preferable to fit the trap below the actual draining point, but when fitted at the top of the rising pipe the choice of trap type is affected because of changed conditions.

Balanced Pressure Thermostatic traps appear to be the most suitable for fitting at the top of a rising pipe, which should be of small bore, so as to maintain an unbroken column of water. Liquid Expansion Thermostatic traps are suitable for top lifting, but mechanical traps generally should not be fitted at the top of a lift if it can be avoided. Float traps should be fitted with a steam lock release and Inverted Bucket traps should have a check valve immediately before the trap inlet.

Check valves are necessary on any job if the condensate return line pressure is likely to be above atmospheric pressure. As to re-evaporation, sometimes advantage is taken of this to recover some of the heat which otherwise would be lost. This can be done when low-pressure plant is operating near high-pressure plant. By allowing the steam traps draining the high-pressure plant to discharge their condensate into receivers connected to the low-pressure steam supply, the flash steam which is generated (as a result of discharging to a lower pressure) is recovered and supplied to the low-pressure equipment. This is another useful way of conserving steam.

Other Bulletins

Other bulletins issued previously dealt with general problems associated with the generation of steam and power in small plants, such as air leakage, brickwork, dampers, by-passing, etc.; water treatment, feed-water heating and heat recovery from blow-down; use of super-heaters; economisers; avoidance of peak demands; maintenance; grates, etc., and the reduction of heat loss by insulation. On the latter question it is stated that it is remarkable the financial benefits which would accrue to industry by the elimination of preventable heat loss through effective insulation.

Advice is also given on how to make a simple steam meter for use in factories, the installation of which should show the value of a reliable measure of the quantity of steam generated and consumed. It is suggested that this might well be followed up by the installation of recording and integrating meters.

Industrial Fuel Supplies

Arrangements for Conversion

THE Ministry of Fuel and Power reminds all industrial consumers and prospective consumers of fuel, that they must not change from one class of fuel to another, or instal new fuel burning plant, without having first ascertained that the fuel will be available. As all types of fuel are in urgent demand, changes may embarrass the general fuel supply position and lead to wasted expenditure of materials and skilled labour. If a change is considered essential consumers will be advised individually by the Ministry of Fuel and Power. The only exception is for the conversion of oil burning plant to use creosote pitch. The Petroleum Board has been authorised by the Ministry of Fuel and Power to arrange such conversions.

If a consumer needs to instal new fuel burning plant, or *himself* feels that the conversion of his plant from one fuel to another is desirable, he should, if he is engaged upon work for one of the Production Ministries (Admiralty, Ministry of Supply, Ministry of Aircraft Production), approach the Ministry principally interested in his production, which will in turn approach the Ministry of Fuel and Power. If he is not engaged upon work for one of these Ministries, he should approach the Division of the Ministry of Fuel and Power responsible for the fuel he intends to use, *i.e.*: (1) The Regional Services Director of the Ministry for the Region, in the case of coal or coke; (2) The Petroleum Division of the Ministry, Dean Stanley Street, London, S.W.1, in the case of liquid fuel (whether petroleum, creosote or creosote/pitch mixture); (3) The Gas and Electricity Division of the Ministry, New Oxford House, Bloomsbury Way, London, W.C.1, in the case of gas; (4) The Coal Tar Control, Quebec House, Quebec Street, Leeds, in the case of coal tar or any coal-tar product other than creosote or creosote/pitch mixture.

The only exception is in the case of electricity, where the Electricity Commission should be approached, through the local electricity supply undertaking. The consumer will then receive advice in the light of local fuel supply conditions.

German Textile Research

Studies of Molecular Structure and Viscosity

ALTHOUGH last summer Hitler had ordered the scientists of Germany to concentrate their whole attention on research that would yield immediate practical results, the dominating note of the Fourth Research Meeting of the ZKR (Zellwolle- u. Kunstseide-Ring) at Weimar, in the autumn, was the urgent need and vital importance of fundamental or pure science research. Into the real distinction (if any) between these two kinds of research and the question of its validity, it is unnecessary to enter here; but it is interesting to note that many of the textile research workers in Germany did not admit the Führer's ability to make such a division, or accept his instructions in the matter. The point was stressed in the opening address, and emphasised in many of the subsequent papers read, that the main purpose of the ZKR is to foster fundamental research in the textile industry of Germany, "and thus for the whole of Europe." The latter sweeping corollary seems a little premature. Only a very brief review of the principal papers submitted has yet appeared in the German technical Press, but it is claimed that much of the work described has not hitherto been published.

Fibre Structure

It had to be admitted early in the proceedings that all artificial fibres, except possibly the superpolyamide products, are inferior to natural fibres, and lack that "something" or indefinable quality which the latter possess. On the subject of fibre structure or morphology, some progress has been made at the Leipzig centre, and Dr E. S. Schiebold described his recent work on electronic methods of investigating molecular structure. Dr. L. Wallner and Dr. F. Gunther, also of Leipzig, followed on the same lines, including not only macromolecular structure but also ultra-microscopic studies of polyamides and polystyrene. On the basis of numerous analyses and calculations of this kind it is hoped that it may be possible to arrive at improved and more complete models of cell structure, both in regard to individual molecules and to the union of several, and thus to obtain an exact picture of fibre structure. Questions of size, position, and spacing of the individual structural elements, especially in the softened or dissolved state, were discussed by Prof. Kratky, of the Dahlem Physical Chemistry Institute, using the so-called low-angle dispersion with X-rays.

Dr. H. Staudinger, of Freiburg-im-Breisgau, one of the best known researchers in macromolecular chemistry, recently completed his 300th paper on the subject. In starting his fourth century at Weimar he reviewed his work on cellulose, including his latest investigations of the relation between chain length and strength of fibre in the polyamide group. This is thought to be a valuable line of approach, and involves a study also of the viscosity of diluted solutions of the material in relation to size and structure of the molecule.

Other papers also dealt with viscosity: Dr. F. H. Müller, of Leipzig University, on specific viscosity and its relation to structure in solutions of high polymers; Dr. Moll, of the Berlin branch of ZKR, on some differences between ordinary cotton and artificial fibres of the cell-wool type, with special reference to spinning methods and degree of polymerisation, using new methods of measurement of extreme accuracy; Dr. A. Marschall, of the textile factory at Zehlendorf, on solubilities of various natural and artificial cellulose products: and several papers on various aspects of swelling, longitudinal and otherwise: treatment of cellulose with formaldehyde; and the effect of introducing foreign substances into the molecular complex, the so-called bridge-building between different parts of the molecular structure. This last may well prove a fruitful line of approach, and has already, it is claimed, yielded some improvement by reducing the risk of injury to synthetic fibres by water or chemicals.

SOFT DRINKS STANDARDS

War-time standards for soft drinks have been prepared by the Soft Drinks Industry (War-Time) Association, and approved by the Ministry of Food in consultation with the Ministry of Health, the Government Chemist, and the Society of Public Analysts. For sweetening purposes, saccharin very largely replaces sugar, and from the point of view of saving shipping it is noted that 73 tons of saccharin give the same sweetening power as 40,000 tons of sugar. Fixed sugar and saccharin contents for both concentrated and unconcentrated drinks are prescribed, and also the minimum citric acid content. Soda water is to contain not less than 5 gr. of sodium bicarbonate per pint.

All concentrated sweet drinks must contain 7.5 lb. added sugar and 1.24 oz. saccharin per 10 gal., and citric acid varying from 7.5 oz. for ginger cordial to 36 oz. for lemon squash. All unconcentrated drinks contain ¾-2¼ oz. citric acid per 10 gal., according to flavouring, also 18 oz. added sugar and 81 gr. saccharin.

A CHEMIST'S BOOKSHELF

EQUILIBRIUM AND KINETICS OF GAS REACTIONS. By Robert N. Pease. London: Humphrey Milford (for the Princeton University Press). Pp. 236. 22s. 6d.

The volume, the sub-title of which is "An Introduction to the Quantum-Statistical Treatment of Chemical Processes" is, in fact, a very good introduction to recent important advances in the application of statistical mechanics to gaseous systems undergoing chemical reaction, treating both the stable state (equilibrium) and the approach to this state (rate). The emphasis lies on the reactions themselves and hence on the experimental data rather than on the general methods of statistical mechanics; more than half of the text is devoted to detailed discussion of the data obtained on particular gas reactions. The book is divided into two parts: Part I dealing with chemical equilibrium in gaseous systems, including the Nernst heat theorem, the third law of thermodynamics and the quantum-statistical calculation of free energy. Part II covers the kinetics of gas reactions, and discusses in a special chapter a group of so-called quasi-unimolecular reactions. The whole of the rather new, but certainly important, field of the interpretation of chemical processes is treated in a way that covers the essentials of the theory and practice of the subject. The book will, therefore, not only prove most stimulating for chemists, but many other scientists as well will find it extremely useful. Comprehensive references to the original literature enhance the practical value of the work.

MODERN SYNTHETIC RUBBERS. By Harry Barron, Ph.D., B.Sc., F.I.C., A.I.R.I. London: Chapman and Hall, Ltd. Pp. 274 25s.

The name of Dr. Barron is an assurance that in a book written by him the subject will be treated authoritatively and comprehensively. In *Modern Synthetic Rubbers* he wisely introduces to British technologists a subject in which they now seem to be precluded from taking an active part, but which will surely be developed here extensively when Government control is withdrawn. Synthetic rubber appears to be a product of war growth. During the last war, when Germany found herself in difficulties in this respect, German chemists were able to manufacture some 300 tons of methyl rubber per month, but with the end of the war the venture ceased and it was not until 1925, when the price level of raw rubber reached absurd heights, that the necessary stimulus arose for the production of synthetic material At about the same time the plastics industry was also developing and, as Dr. Barron points out, synthetic rubber is a plastic. Since synthetic rubber is now openly intended for use instead of rubber Dr. Barron finds it necessary to weigh the properties of the synthetic material against the industrial and technical background of natural rubber. The development of the synthetic material is no abstract venture of the financier, but appears to have been due to a very definite need. Dr. Barron points out that natural rubber has failed to meet a number of requirements, principally in regard to corrosion and wear, and on this account the search for synthetic substitutes became urgent and supplied the thin end of the wedge for the development of better materials which are now made synthetically for certain purposes, although at higher cost, than the natural product.

Dr. Barron divides his book into three parts, the first of which, "General Considerations," weighs up the differences between natural rubber and synthetic materials and discusses the economics of synthetic elastic materials. Part 2, "Chemical and Physical Background of Synthetic Elastic Materials," discusses the historical background of synthetic elastics and the chemical behaviour and structure of natural rubber. The raw materials, alcohol, acetone, and petroleum, are then discussed and three chapters are devoted to polymerisation, co-polymerisation and emulsion polymerisation. This section contains an ecount of the technique of the production of elastic plastics. Part 3 deals with the technology of synthetic elastic materials, and covers the whole of the materials which are now used in this field. Butadiene is the principal material for the manufacture of the great bulk of the synthetic rubber materials now made. There is no space here to delve into the many interesting aspects of this subject with which Dr. Barron deals; it is enough to indicate that this book is one which no one interested in rubber or its uses should be without It provides a fund of interesting information which will form the background to the developments undoubtedly due in years to come.

A LABORATORY HANDBOOK OF PULP AND PAPER MANUFACTURE. By Julius Grant, M.Sc., Ph.D., F.I.C. London: Edward Arnold. Pp. 320. 28s.

This book, incorporating the fourth edition of Steven's "The Paper Mill Chemist," is the most complete treatise which has so far appeared in its field and is divided into nine parts. Part I is a brief and simple introduction into the scope and function of a mill laboratory; Part II deals with fibrous raw materials and the preparation of semi-manufactured products; Part III deals with non-fibrous raw materials used in the preparation of semi-manufactured products; Part IV aims at a summary of half-stuffs and their evaluation; Parts V and VI proceed to the actual processes of paper manu-

facture in describing the beater house, the machine house and "after" processes; Parts VII and VIII give a survey of paper-testing by physical, chemical, and microscopic methods, while Part IX treats of paper-testing by special methods, contains statistical analyses, and deals with fuel and water, both of obvious importance in paper mill operations. Full bibliographies are added at the end of each chapter and reference data are culled from many sources. These, as well as many plates, figures and tables, will be useful to all concerned in paper manufacture. Although the book does not claim to be a complete text-book either of papermaking theory or of practice, it includes all workable methods up-to-date and is written in a readily comprehensible style. It maintains the high standard of its predecessor, Steven's well-known "The Paper Mill Chemist." It may be mentioned that independently and nearly simultaneously a book entitled "Modern Pulp and Papermaking. A Practical Treatise," by G. S. Witham, has recently been published by the Reinhold Publishing Corporation of New York.

EXPERIMENTAL RESEARCHES AND REPORTS, Vol. xxiv. Sheffield University: Department of Glass Technology. Pp. 340. 7s 6d.

Evidence of the width and scope of research work on behalf of the glass industry can be ascertained by reference to the excellent report by Professor W. E. S. Turner on Progress in Technical Development and Research under the auspices of the Glass Delegacy during 1940-41. Further researches have not only been carried out regarding the chemical compositions of a large number of sands for making colourless glass, but, as the report states, considerable work is now being undertaken by the Department with a view to preparing Society of Glass Technology Specifications on: (1) Sands for Colourless Glassmaking; (2) A Method for Determining the Thermal Endurance of Glass; (3) Standard Methods for the Determination of Viscosity; and (4) The use of standard strain discs in the control of annealing. The report of the Research Programme Advisory Committee enlarges on the research work and gives a detailed list of reports and memoranda considered during the year.

Miss Violet Dimbleby, M.Sc., contributes as usual her Chemical Analyses as applied to Glasses and Silicates, and to Raw Materials for Glass Making. She says that of outstanding interest in the year's publications is that of the American Society for the Testing of Materials, entitled "Tentative Methods of Chemical Analysis of Soda-Lime Glass" which covers procedures for use in referee as well as in routine analyses of simple glasses in which not more than 0.5% of F_2, 2.0% of BaO, 2.0% of B_2O_3, 0.10% of P_2O_5, 0.10% of ZnO, 0.05% of Sb_2O_3, and 0.05% of PbO are present. As some of the methods given differ from those in general use in this country readers should find the work of interest.

Many other interesting papers by Professor W. E. S. Turner, Eric Preston, Ph.D., D.Sc., F.I.C., F.Inst.P., A. J. Holland, M.Sc., Ph.D., A.R.C.S., D.I.C., R. Halle, B.Sc. Tech., N. A. Nickols, M.Sc. Tech., M.Eng., M. Parkin, M.Sc., A.I.C., and James Boow, B.Sc. Tech., Ph.D., are included in this work of research. The papers published therein were collected from the *Journal of the Society of Glass Technology*, *Transactions of the Faraday Society*, *Proceedings of the Physical Society*, and *Glass Review*. Most of the 22 papers contain references which should prove invaluable to all technicians in the industry.

AN INTRODUCTION TO INDUSTRIAL MYCOLOGY. By George Smith and Harold Raistrick. 2nd Ed. London: Edward Arnold. Pp. 260. 20s.

Since the publication of the first edition of this work in 1938, new light on the subject of the Yeasts has come to hand, and the section dealing with them has been considerably expanded to form a separate chapter. A simpler scheme of classification of the Hyphomycetales has also been provided, which is better adapted to the needs of the beginner. With these few alterations, the book remains a standard work for those who are beginning the study of "moulds" rather than that of fungi in general; the latter subject has already an extensive literature. The descriptions and illustrations of the types which are of most ordinary occurrence in industrial surroundings are of the highest practical value, and the chapters on laboratory practice offer sound assistance to the beginner. A concession to war-time economy has had to be made by printing the plates on both sides of the paper, but this is a small matter in a book of such importance, and one at which only the most critical will cavil.

Preprints of some sections of the Report of the Smithsonian Institution, Washington, for 1941 have been issued. These include essays on the History of Plastics, by G. M. Kline, and of Synthetic Textile Fibres, by H. R. Mauersberger. Most of the materials described have been dealt with in our columns at one time or another, but it is convenient to have their development described in parallel in one publication. "The New Frontiers in the Atom" contains some fascinating photographs of the progress of the "atom-smashing" apparatus, the cyclotron. Professor Ernest O. Lawrence, appropriately enough, is the author.

Chemicals in South Africa

Development of Local Products

From Our Cape Town Correspondent

AFRICA need not now find itself being deprived of quinine as a result of the blows struck by the Japanese at the Far Eastern sources of supply of this indispensable remedy against malaria. In another year or two, it is maintained, the Belgian Congo, which is already producing quinine, will be in a position to meet the demands of the whole of Africa. This has come about as a consequence of the planting of cinchona trees in Kivu a little while ago on the invitation of the Belgian Chemical Society. The quinine from these plantations is expected to be equal in quality to the best that the Dutch East Indies supplied in the past.

Insecticides

Japan will not recover her market in one commodity when the war is over. Insect sprays will then be made from materials supplied by the British Empire, including South Africa and East Africa. Enormous progress has been made since the entry of Japan into the war in developing substitutes for certain vegetable products, all of which that country once controlled in world markets, products which were essential in making insecticides. Before the present war, Tanganyika produced barely £20,000 of pyrethrum seed, the very fine particles of which are used in sprays. To-day, Tanganyika is supplying over £100,000 worth annually, and only shortage of labour prevents even greater production. In South Africa there has also been an advance. There another variety of pyrethrum is also being used, the ox-eye daisy, which has been shown to possess valuable qualities in the making of insecticides.

The war has brought home the growing shortage in South Africa of nicotine insecticides, and the opportunity presents itself for the manufacturing of this product on a large scale. Fruit farmers will be seriously handicapped this year by their inability to obtain sufficient supplies of this insecticide to combat the codling moth. Some authorities say that unless supplies of this insecticide can come forward in the very near future, 75 per cent. of the South African fruit production will be of poor grade in the coming season.

Oils and Pastes

A Jeppe firm is marketing a cleaning paste suitable for cleaning of all descriptions, and for removing grease and grime. It is packed in 2-lb. tins. A new factory has been erected in Salisbury, Southern Rhodesia, to make a refined salad and cooking oil, and also to manufacture oilcakes and cattle foods. A South African lip-salve in a tubular cardboard container is now beginning to make headway in the local market. The Controller of Soaps and Oils has gazetted a notice forbidding the use of mineral oils, vegetable oils, or fats, in the manufacture of hair preparations of any type other than shampoo preparations.

Citrus Concentration

A plant for the manufacture of "concentrate toffees" from citrus, each toffee equivalent in nutritive value to an orange, but about one-tenth of the weight, is now in operation in Johannesburg. The plant is the first of its kind in South Africa. It can deal with about five tons of citrus a day. So successful has the process proved that other and possibly larger plants are contemplated. One interesting possibility is the export of the concentrates to Britain and other countries where citrus is unobtainable under war conditions. Only a small proportion of the shipping space required for the export of the "whole" citrus would be necessary. The concentrate is the result of more than a year's research by Dr. Bernard Segal, of the University of the Witwatersrand. As well as preparing the "toffee," which was tested and approved of by the South African Institute for Medical Research, Dr. Segal designed the plant for commercial production and supervised its erection. It was obtained from the combined juice and extractives of whole oranges, there being virtually no waste in the process. A portion of the skin was used for the extraction of orange oil, and a portion was made into candied peel. Only the pips were thrown away. The "toffee" contained all the solids and nutritive qualities of orange juice in unimpaired form. It retained 90 per cent. of the original juice. The solid was perfectly stable, and did not undergo fermentation or bacterial decomposition—a handicap common to liquid concentrates. The "toffee" had a pleasant orange taste, and could be dissolved slowly in the mouth or placed in water, in which it was fairly soluble, to give an "orange drink." Dr. Segal said: "Oranges are an excellent and abundant source of vitamin C, which is an essential food factor. Our nutritional authorities have been at great pains to supply our troops in the North with their requirements of the vitamin, and these toffees

could provide a convenient means of doing so. This new development will open up many possibilities for citrus growers, for all types of oranges can be used in the process. Samples have been sent to the British Ministry of Food and to chemists and private individuals in Britain, and all reported favourably. There was a further use for the toffee among the natives and poorer sections of the European community in South Africa.

Sodium thiosulphate for industrial purposes is being made in Port Elizabeth. A Durban concern proposes to erect a glue and gelatine factory at Springs, Transvaal. A firm at Industria, Johannesburg, is manufacturing a special meat-marking ink for use of livestock dealers and butchers in conformity with the recent price-control regulations applying to meat. The ink is made in scarlet, black, violet, and red, and is to be had in 26 oz., half-gallon, and gallon containers. The ink is non-poisonous, conforms to health and food laws, and is suitable for marking meat, vegetables and fruit.

In their report for the year to June 25 last the directors of the South African Torbanite Mining and Refining Co. state that £28,555 debentures were redeemed, leaving a balance of £307,695. The loan indebtedness was reduced by £15,000 to £100,000. Of a trading profit of £70,456, taxation absorbed £3,000 and interest charges £22,530. There remained a net profit of £43,175, against a loss of £32,775 during the preceding year. From this the debit balance of £16,530 has been written off, leaving £26,645 to the credit of profit and loss account. The improved results were brought about principally by reduced production costs connected with a higher output of torbanite crude oil and improvements in process technique. Owing to the impossibility of chartering tankers for the importation of crude oil, the refinery has been running entirely on crude torbanite. By arrangement with Government and group oil companies, the production was augmented by the addition of imported petrol. From 123,031 tons of torbanite, the company produced 6,373,150 gallons of oil, compared with 4,200,915 gallons during the previous year. By-products were also sold. Capital expenditure totalled £22,478, and a coal plant, previously held under hire-purchase, was bought outright. Stocks of products decreased from £94,636 to £43,236, while the fixed assets have been reduced from £710,447 to £684,627, after providing £45,000 for depreciation on the principal items.

Oil-Retaining Bearings

Some Uses for Porous Bronze

IN nearly every class of machinery, bearings of some type or other are necessary, and although the bearing is a comparatively small component of the complete machine, it is of utmost importance; a failure inevitably leads to a stoppage of the machine, with a consequent serious loss. Because of the importance of efficient bearings the whole subject is worthy of more than passing consideration, particularly as to the type of bearing to adopt. If an engineer were asked to give his idea of a first-class bearing, he would probably specify one of good quality metal, strong, accurate, and charged with lubricant that would be automatically fed to the running part in quantity varying to the load and do so over a long period without attention.

A bearing of the oil-retaining type, of die-pressed true alloy bronze, heat treated and oil impregnated, feeding oil by capillary attraction to the shaft or other moving part, has been developed by Bound Brook Bearing (G.B.), Ltd., of Witton, Birmingham, under the name "Compo H." Reasons claimed for the success of these bearings include the following: (1) freedom from lubricating difficulties; (2) freedom from impurities found in castings; (3) extreme accuracy; (4) smooth finish; (5) quiet performance; (6) low coefficient of friction; (7) reasonable cost; (8) economical methods of installation.

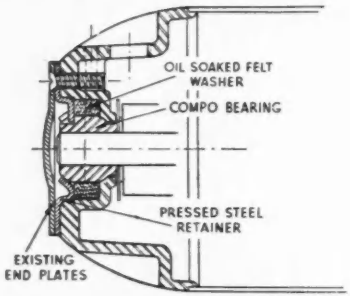
The amount of oil the bearings absorb is about 30 per cent. by volume, and this oil is fed to the shaft as and when required. In all conditions of load the film of oil is maintained between the shaft and the bearing, thus preventing metal-to-metal contact, the cause of friction. The bearings here described, however, are adaptable to load conditions, for when a varying amount of lubrication is required, the temperature of the bearing controls the supply of oil. In the majority of applications, additional oil is not required, but in exceptional cases, a replenishing of oil is advisable and this can easily be done in a variety of ways, as oil touching the bearing in any part will quickly be absorbed. Oil holes and grooves are not necessary.

As to the extreme accuracy and smooth finish of "Compo H" bearings, it is stated that bore diameters are easily held within ±.0005 in. of normal size, and other dimensions within ±.001 in. to .005 in. or even closer limits. Being a die-pressed job made with tools carefully ground and

lapped, no machining is necessary and the finished product has a mirror surface. It is claimed that a strong magnifying glass will show no ridges or tool marks so usual in machine-finished bushes.

Inside and outside diameters of the bearings are made of a suitable oversize, generally 0.003 to 0.004 in. above the housing size and the shaft size, so that after insertion, by pressing into a reamed housing hole, the bore closes in about 0.002 in. leaving the proper running clearance between bearing and shaft.

These bearings may be turned with pointed tungsten carbide tools, reamed, diamond bored, or burnished. They may also be moulded directly into rubber, plastics, and die castings. Before installing them it is well to dip them into a good



Example of installation of a self-aligning bearing, with oil-soaked felt washer.

grade of medium heavy oil. This will wash off any dust or foreign matter adhering to the oily surface of the bearings and provide sufficient oil to fill the space between the bearing and shaft. They should be kept away from grit contamination, and after storage a few drops of good oil should be applied to the shaft before assembling.

"Compo H" material analyses as follows: copper, 88.0 per cent., tin, 9.7 per cent.; graphite, 1.4 per cent.; other material, 0.9 per cent. Other technical data include:

Specific gravity	5.8-6.5
Coefficient of friction	0.10
Rockwell scale "B" 1/16 in. ball 100 kg. load	97-100
Oil content by volume ...	23-30 per cent.
Crushing load, about	70,000 lb./sq. in.

Where p = pressure in lb./sq. in., and v = velocity in ft./min., pv = 20,000 without additional lubrication, and 50,000 with additional lubrication; but, in calculating permissible loads, conditions ideal or otherwise must be carefully considered before utilising any particular pv factor. In general, it may be said that these oil-retaining bearings will carry a load equal to well lubricated bronze, and that when such bearings have a length of one to 1½ times the diameter, and a shaft sufficiently strong to carry the load without excessive deflection, there should be no trouble in meeting any load conditions provided that the housing can dissipate the heat.

Carnegie Institution

Peace and War Researches in Parallel

WAR work now absorbs the major part of the research staff and laboratory facilities of the Carnegie Institution of Washington, according to the presidential report of Dr. Vannevar Bush. Dr. Bush has taken on war-time duties as director of the U.S. Office of Scientific Research and Development and chairman of a joint committee on new weapons and equipment, in addition to his permanent position as president of the Institution. His example has been followed by many members of the research staff, 34 of whom have taken leave of absence to devote full time to war-time tasks in the Government, while 145 others who remain at the Institution are devoting all their time to the furtherance of the 23 research projects covered by 48 contracts with the Government.

This concentration on war effort does not mean, however, that the many peace-time research programmes have been altogether discontinued. Some of the work carried on by the Institution requires an uninterrupted series of daily observations, while other projects are so near completion, and have already involved so heavy an outlay of time and money, that it seems advisable to carry them through.

While the great majority of the Institution's war-connected researches are necessarily secret and confidential, a few examples, out of many scores discussed in the report, include:

(a) Efforts to develop varieties of hemp for the new fibre-production programme that will yield little or no marihuana. An apparent correlation between double or triple chromosome numbers and high marihuana concentration has been found.

(b) Improvement of the Russian rubber-yielding dandelion, kok-saghyz, by breeding methods, especially by treatment with colchicine.

(c) Discovery that there is more than one kind of chlorophyll in plants, and hence more than one kind of photosynthesis, the basal food-making and fibre-forming process. The food-making pigments have been found in certain algae, which are the ultimate food of fish and which may have had something to do with the formation of the world's oil pools.

Personal Notes

MR. SAMUEL MCMANNERS has been appointed general manager of Lewis Berger and Sons, Ltd.

MR. J. L. BENNETT, of the Hercules Powder Company, has been elected president of the American Institute of Chemical Engineers.

MR. E. H. GILPIN, chairman of the Food Machinery and Chemical Plant Export Group, has been appointed chairman of the Executive Committee of the Liberal Party.

DR. C. H. MATHEWSON, chairman of the Department of Metallurgy at Yale University, has been elected president of the American Institute of Mining and Metallurgical Engineers.

MR T. E. B. YOUNG has been released from his duties as Director of Production in the Ministry of Fuel and Power. He has returned to his post with the Bolsover Colliery Co., at the special request of the chairman, owing to the illness of the company's mining agent.

MR. ANTHONY GEORGE MALDON MICHELL, of Melbourne, Australia, has been awarded the James Watt Gold International Medal by the Institution of Mechanical Engineers for his scientific work. He is famous particularly for his turbine-engine bearings. Mr. S. M. Bruce, High Commissioner for Australia, received the medal in London on Friday last week, on behalf of Mr. Michell.

MR. F. SCOPES has been appointed a director of Stewarts and Lloyds, Ltd. MR. WILLIAM STEWART has resigned the secretaryship of the company and of the subsidiary and associated companies, and MR. L. M. T. CASTLE has been appointed secretary in his place. Mr. Stewart retains his seat on the board of the company and of subsidiary companies.

DR HAROLD MOORE, C.B.E., has been awarded the Institute of Metals Medal for "outstanding services to non-ferrous metallurgy." The presentation will be made at the annual meeting of the Institute on March 3. In a long and distinguished metallurgical career, Dr. Moore, after thorough experience in industry, became Chief Metallurgist at the Research Department, Woolwich, in which he was Director of Metallurgical Research in 1919-32. Since 1932 he has been Director of the British Non-Ferrous Metals Research Association. In 1934-36 he was President of the Institute of Metals, of which he has been a member for 23 years. The medal, which is offered to the Council of the Institute by the Mond Nickel Co., Ltd., for award annually, is of pure platinum, the metal of which it is composed being prepared at the company's refinery at Acton, London.

MR. E. J. HANCOCK, general sales manager of English Clays Lovering Pochin and Co., Ltd., is retiring on grounds of ill-health Mr. Hancock, who has held his present position since 1932, was the guest of honour at a farewell luncheon in Manchester given by members of the firm's Northern Area staffs.

Obituary

MR. GILFRID GEORGE BAKER-CRESSWELL, who died at Chathill, Northumberland, on January 25, aged 94, was for many years an Inspector of Factories in the West of Scotland.

MR. DONALD MACASKILL, former vice-president and general manager of the International Nickel Co. of Canada, Ltd., has been found dead at his home in Toronto. He was 65 years of age.

CAPTAIN EDWARD BROTHERTON RATCLIFFE, Intelligence Corps, is reported to have died of wounds received on active service in North Africa. Son of the late Mr. Edward Brotherton Ratcliffe, and nephew of Mr. Charles R. Brotherton, chairman of Brotherton & Co., Ltd., Leeds, Captain Brotherton Ratcliffe had been associated with the company for a number of years. At the outbreak of war he was living at Bromborough, Cheshire, and was working as a chemist on the chemical staff of Brotherton & Co.'s Merseyside works. Although "reserved" he succeeded in joining the Army soon after the war began. He was 28 years of age.

LORD HIRST OF WITTON, a founder and, since 1910, the chairman of the General Electric Co., Ltd., died at Earley, near Reading, on January 22, after a short illness. He was 79 years of age. The son of Emmanuel Hirsch, of Munich, Hugo Hirst originally studied chemistry with a view to entering his father's distilling business, but his career really began in 1886 when he participated in founding a "little electrical shop," as he called it, in London. From this small seed, the G.E.C., established in 1889 and now employing 50,000, has grown. Thanks, no doubt, to his early technical training, Lord Hirst was among the first to realise the importance of research in industry, with the result that his company's research laboratories are among the finest, and the names of its scientists and technicians among the best known in the world. In 1936-38 Lord Hirst served as president of the Federation of British Industries; he was a past president of the Association of Technical Institutions; and a past president and founder of the Institute of Fuel. His only son, Lieut. Harold Hugh Hirst, Manchester Regiment, died early in 1919 as a result of war service; and Lieut. Hirst's son, Harold Hugh, the only heir to the title, joined the R.A.F. in 1939 and was killed on operational duties in 1941.

The Society of Individualists

Impressive Attendance at Inaugural Meeting

THE great hall of Winchester House, Old Broad Street, E.C., was packed to the doors for the inaugural public meeting of the Society of Individualists on January 21. Lord Leverhulme, who presided, said that the name "Individualist" served the great purpose of reminding them that the unit of Society was the individual. It embodied the belief that the State existed for the individual and not the individual for the State. "Individualist" might be regarded, therefore, as being the direct opposite of "Totalitarian." While comparatively few people wanted to see this country become a totalitarian state, the British public might be persuaded into accepting, step by step, a programme of State planning which might ultimately mean control by Government of every phase of national life. In the name of "planning," industry, for instance, would be controlled and the consumer would have to be controlled too. He did not suggest that government could be entirely eliminated from the industrial and economic scene. Their claim was that individual enterprise and initiative should be given assistance and encouragement and should not be superseded by State ownership, control or management.

The President's Address

Sir Ernest Benn, in his presidential address, said that the Society of Individualists was formed to assist and encourage all who regarded the totalitarian state as the lowest form of human degradation and were determined that no such fate should befall Britain. Numerous forces now at work, many of them operating from Whitehall itself, must be boldly and publicly arraigned as the agents of totalitarianism. Some people thought of that term only as a matter of Gestapos, rubber truncheons, and the persecution of Jews. They forgot that it started with a long catalogue of social reforms, including the people's motor-car. It was not cricket to use strictly temporary war powers to tamper with the Constitution or debase the personal qualities of British citizenship. Certainly Parliament had no mandate for anything of the kind; indeed, Parliament should apply for affiliation to the Society of Individualists, for the powers so freely delegated for war purposes now threatened Parliament itself. When Sir William Beveridge said that he "hoped to retain something of the present parliamentary system" all doubt of the serious nature of the threat to democracy was removed, as was also doubt of the need for their new society which, indeed, might well assume the more impressive title of Committee of Public Safety.

Totalitarian State management must be resisted because the spiritual and moral degradation of regimentation was wholly alien to the British character and because they could not keep themselves alive that way. Hitler, the most accomplished and experienced of planners, had already allotted to Britain a population of sixteen millions, and he (Sir Ernest Benn) accepted that figure as approximately accurate under any planned economy, whether the plans were made in Whitehall or in the Wilhelmstrasse.

Aims and Functions of the Society

The Society of Individualists was not a political party with a leader whom all must follow, or a programme to which all must adhere. They had no parliamentary aspirations, and he was not aware of any plans for running parliamentary candidates. Their aim was to arouse the latent manhood of the nation to a full sense of the danger of the slave-creating tendencies to be discerned in greater or less degree in all political parties. The functions of the Society did not in any way conflict with the work of those courageous people among whom were many of its members and who took an honourable part in the difficult, practical, day-by-day work of Government. That work would be more easily and better performed if, outside and by the side of it, they maintained a steady force of protest against easy natural tendencies to govern to excess. The road from democracy through bureaucracy to totalitarianism was a broad easy speedway which had attractions for many well-intentioned, but wholly misguided people. The State not only engendered the spirit of dependence, but it alone could wage war. It followed that every addition to the functions, the interests, the powers of the resources of the State added to the reasons for, and consequently the possibilities of, war. The "freedom from fear" offered in the Atlantic Charter could best be secured if Governments refrained from setting up vast State interests in raw materials and markets, for these in the hands of governments offered a constant and positive invitation to the spirit of aggression.

Their task was not easy. There were against them the strongly entrenched vested interests of officialdom. In addition they had to deal with large numbers of well-meaning people, from Archbishops downwards, who, selecting specious little items from the catalogue of the planners, all of

which could be found in Hitler's *Mein Kampf*, failed to understand that those little bits were portions of a designed whole and could not be, in practice, separated from the complete totalitarian structure. They therefore called upon all men and women of goodwill to join their ranks, boldly to proclaim themselves Individualists and to do their utmost to avert the collapse and calamity which lurked in the wake of collectivism.

Sir Frederick Hamilton said that the Beveridge Report proposed to nationalise a large and highly important section of business. It proposed to force virtually all the members of a great and learned profession into the ranks of the Civil Service. It imposed large contributions upon employers, employed and the general taxpayer. It touched, at some point or another, the lives of every man and every woman. Yet its validity was based to a great extent upon certain large assumptions regarding post-war conditions, such as the average of unemployment, the price level, and the influence of the scheme upon the rate of wages. He submitted that to ask the present Parliament in the circumstances of the time to decide upon principles of such vast scope and tremendous importance was a breach of something much more important than the political truce. It was asking the country to disregard every convention which was implicit in democracy.

Dr. C. K. Allen moved the following resolution :—" That this meeting approves the terms of the Manifesto on British Liberty, and Pledges itself to do its utmost to support the work of The Society of Individualists." Mr. Donovan Touche seconded the resolution, which was carried unanimously and with acclamation.

Parliamentary Topics

Scientific Advice: Utility Paint

IN the House of Commons last week Mr. A. Edwards asked the Minister of Production whether the scientific advisers on his staff now reported direct to him instead of through the Lord Privy Seal. Mr. Lyttelton replied in the affirmative, and added that the Lord President (Sir John Anderson) had agreed that the scientific advisers should also have direct access to the Scientific Advisory Committee, of which he had recently become president.

In reply to a question by Mr. Salt, Mr. Attlee said that no change in the scientific direction and co-ordination of the war effort were involved in the appointment of his personal scientific adviser as Paymaster-General and the transfer of the Lord Privy Seal to the Ministry of Aircraft Production.

The Minister of Supply, Sir Andrew Duncan, in a written reply, stated that the Board of Trade was discussing with the Paint Federation the distribution of a general purpose paint for domestic use. He said that provisional arrangements had been made for a supply of linseed oil for such paints and that steps were being taken for the release of certain quantities of other necessary raw materials when the Board of Trade had completed their arrangements.

Potassium Carbonate

Two-Stage German Process

A NEW process for the manufacture of potassium carbonate, which has been used for several years by Salzbergwerk Neustassfurt, a subsidiary of Kali-Chemie A.-G., is now described. Among the advantages claimed are comparatively small apparatus, continuity of operations owing to the speedy course of chemical reactions, good output quantities, and small cost of energy. Raw materials used are potassium sulphate, lime, and coke. The process may be divided into two parts, the former of which results in the production of potassium formate. Potassium sulphate and milk of lime are treated in autoclaves at temperatures above 200° C., and at high pressures with gas containing 30 to 32 per cent. carbon monoxide produced from coke, so that a concentrated solution of potassium formate is obtained. Calcium sulphate is produced as a by-product, and by selection of suitable operating conditions the inclination of calcium sulphate to bind potassium is overcome. Small quantities of potassium sulphate and soluble calcium salts still present in the formate lye are removed by precipitation with potassium carbonate and evaporation. The second part consists of a calcination process. The primary product is potassium oxalate, and the final product is 99.5 per cent. K_2CO_3. The oxygen required for the oxidation of the formate is supplied by the surplus combustion air.

New Control Orders

Bolts and Nuts

The Minister of Supply has made two Orders controlling the supply and prices of bolts, nuts, screws, screw studs, washers, and rivets, both of which came into force on January 25. These are the Control of Iron and Steel (No. 28) Order (S.R. & O. 1943, No. 40) and the Control of Bolts, Nuts, etc. (No. 1) Order (S.R. & O. 1943, No. 41). By these the provisions relating to bolts, nuts, etc., in the Control of Iron and Steel (No. 15) Order (S.R. & O. 1941, No. 1010) are deleted, and the buying and selling conditions, quantities, and prices of various types of bolts, nuts, etc. (both ferrous and non-ferrous), are regulated.

General News——From Week to Week

J. T. Coats and Co., Ltd., manufacturing chemists, of Broughton Laboratories, Edinburgh, have been accepted as a member of the Edinburgh Chamber of Commerce.

An explanatory and financial memorandum of the Hydro-Electric Development (Scotland) Bill which is now before the House of Commons, has been published by H.M. Stationery Office, price 7d., post free.

The "Paper Goes to War" exhibition at the Royal Exchange, London, will be open on weekdays from 10 to 4 until February 12. Employers are asked to give their staffs time off to visit it. Stationery buyers and office salvage stewards in particular will find there many useful suggestions.

Plastic plates for printing are the subject of extensive tests and experiments now being carried out by the British and United States Governments. It is hoped to produce a plate which, unlike its predecessors, will not require vinylite resin or other plastics now on the priority list in its manufacture.

A specification for polyvinyl chloride compounds, No. 1001 (for sheathing electric cables), and No. 1002 (for insulating conductors of electric cables), has been issued by the War Office (Government Department Electrical Specification, No. 18, 1942; price 2d., post free, from H.M.S.O.).

At the fourth annual general meeting of the Association of British Organic Fertilisers, Ltd., held in London on January 8, the following honorary officers were elected for the current year: President, Mr. M. A. Condell (Thomas Elliott, Ltd.); vice-president, Mr. S. L. Sheldrick (David T. Boyd and Co., Ltd.); treasurer, Mr. H. G. Chamberlain (A. J. Bell, Ltd.).

Mr. H. A. Astbury, chief general manager of the Midland Bank, will retire on January 31, after over 50 years' service, but retains his seat on the board. The following appointments take effect on February 1: Mr. C. T. A. Sadd and Mr. G. P. A. Lederer, assistant chief general managers, to be chief general managers; Mr. A. Woods, manager of New Street Branch, Birmingham, to be a joint general manager.

A major change in the law of taxation of business is required in order to meet the financial needs of industry, according to a memorandum addressed to the Chancellor of the Exchequer by the F.B.I. This advocates the financing of industry by the retention of profits, which should be granted some measure of tax relief. Machinery would be needed to ensure that such surpluses would be subject to the full taxation rate if they were later distributed.

The branches of the Raw Materials Department of the Ministry of Supply which were accommodated at the Castle, Warwick, have (with the exception of R.M.I.B.) been moved to 6 Carlton House Terrace, London, S.W.1 (tel.: WHItehall 4341; telegraphic address: Matzraw Piccy London).

Among the salvage operations conducted by the Western Command of the British Army, the recovery of dirty oil takes a prominent place. Not only does the Army use this, when filtered, as second-grade oil, but it also employs as a heating fuel the cleaned "sludge oil" from seagoing ships, which is being converted, in the North-West, by a process devised by a young French refugee.

A request that motorists should drop empty tubes that had contained rubber solution for mending tyres, into the empty tooth-paste tube salvage bins to be found in chemists shops, has been made by the Tyre Manufacturers' Conference. The suggestion has been approved by tooth paste makers. All profits on the sale of these tubes go to the Red Cross and St. John Fund.

Processed raw materials, amounting to almost 9000 tons, formerly lying idle in factories as surplus stocks, were last year transferred to other works which needed them urgently to complete war production contracts. The transfers were effected through the National Stock List, a monthly publication issued by the Ministry of Supply. A production exchange has been opened at Wolverhampton, where business men of the 1700 Black Country firms which it serves meet weekly to adjust differences in capacity and to balance their productivity.

Visitors to the "Paper Goes to War" exhibition, which was opened at the Royal Exchange on January 28, will be astonished at the number of purposes for which paper is used in the war effort. For example, layers of specially treated paper are put under concrete aeroplane runways to prevent moisture from seeping through. Specially prepared paper is used for packing medical supplies, engine parts, etc., and for mixing and packing high explosives. Paper for the last has to be carefully selected, as it must be guaranteed to be free from all metal content, there being a certain percentage of metal in most types of paper.

Foreign News

The directors of the South African Carbide and By-Products Company report that the company's carbide is still in demand, and that the factory worked at full capacity throughout the year.

The Canadian Prime Minister outlined last week a Government plan providing for the nationalisation of the steel industry in an effort to settle strikes.

Production of caffeine citrate in India has increased owing to orders placed by the Medical Stores Department. Tea planters are now turning over tea waste to Indian firms instead of exporting it.

A translation of the earliest known metallurgical book (1540), the "Pirotechnia," of Vanoccio Biringuccio, has been published by the American Institute of Mining and Metallurgical Engineers.

Thirty-eight representative American chemical manufacturers made a total net profit of $431,000,000 in 1941, as against $275,000,000 in 1940, according to the Securities and Exchange Commission.

Production of refined lead in Peru amounted to 32,871 metric tons in 1941, according to official statistics, making a new record in the rapid ascent from the small start of only four tons in 1933.

Shareholders of the Standard Chemical Company of Canada are notified that the directors consider it advisable to postpone dividend action for 1942 until next March. Interim dividends of 50 cents per share were paid in December, 1940 and 1941.

A fellowship of cellulose chemistry and plastics technology at the Mellon Institute, Pittsburgh, has been founded by the Hawley Products Company, St. Charles (Ill.). Dr. J. C. Williams, of Iowa State College, will be the first holder.

A method has been developed by Du Pont de Nemours for converting nylon yarn waste back into some of the complex chemicals from which the fibres were originally made. A salvage drive for nylon has accordingly been started in America, and waste will be collected from factories.

The erection of a large plant in Saskatchewan, Canada, for the manufacture of industrial and anhydrous alcohol from Canadian grain is under consideration, according to Press reports. The product of the proposed factory would be used in making synthetic rubber.

A new fertiliser, which is said to enjoy increasing favour among market gardeners in Holland, is described as a by-product obtained in the production of methane gas. Good results are claimed to have been achieved with the new material, which on chemical analysis showed an average content of 1.5 per cent. nitrogen, 1.4 per cent. phosphoric acid, and 1.6 per cent. lime. In view of the small contents of valuable elements, its use is probably advantageous only within short distance of the place of production.

The Munitions and Supply Department of the Canadian Government has formed three new metal committees to co-operate with the Metals Controller. These are: the Babbitt Advisory Committee; the Non-Ferrous Wrought Alloys Advisory Committee; and the Solder Advisory Committee.

Potasas Ibericas S.A., the Spanish potash producer, reports for the past year that exports increased by 19½ per cent. and sales in the home market by 31 per cent. The stocks of potash salts were reduced by 25 per cent. Satisfactory development is expected in the future.

Maximum selling prices for sulphuric acid of different grades have been fixed by the Government of India, in accordance with the powers conferred by the Sulphuric Acid Control Order, 1942 (*see* THE CHEMICAL AGE, December 5, p. 510). The prices vary considerably according to district.

Ownership and control of any inventions developed in the U.S.A. by employees on government time or with government equipment will, in future, be assigned to the Federal Government in the interests of national security, it has been announced by the Secretary of the Interior, Harold L. Ickes.

More ammonium sulphate is to be manufactured in Portugal to meet the urgent needs of farmers and vine-growers, the shortage of imported fertilisers having become serious. The Companhia Union Fabril and the Sociedade Anonimo Portugues will begin production as soon as the necessary plant can be installed.

An appeal for quinine has been addressed to the chemists of America by the president of the American Chemical Society, Dr. H. N. Holmes. He has asked them to sell their reserves of quinine to the Government for the use of the armed forces. A search in New England university laboratories has already yielded substantial results.

The control of airborne disease by chemical means has been making great strides in America, according to the medical correspondent of *The Times*. In addition to the well-known use of sodium hypochlorite, propylene glycol has been extensively employed, while ultra-violet radiation from mercury-vapour lamps placed 8 ft. above the floor has also been utilised with success.

In view of the vast resources of vegetable oils in Brazil, the possibility of establishing a fullers' earth industry is particularly attractive. So far, however, the material has been produced on a small scale only, one or two companies exploiting the deposits of decolorising earth that have been found in S. Paulo province. The chief concerns appear to be the Companhia Argilas Industriais, Ltd., and the Cia. Agostinho Barcelos.

Forthcoming Events

The Llewelyn B. Atkinson Memorial Lecture of the **Royal Society of Arts,** John Adam Street, Adelphi, W.C.2, will be given by Dr. P. Dunsheath and Dr. C. C. Paterson, at 1.45 p.m., on **February 1.** The subject is "Industrial Research in Great Britain: a Policy for the Future."

A meeting of the **Society of Chemical Industry,** London Section, will be held in the Chemical Society's Rooms, Burlington House, W.1, at 2.30 p.m., on **February 1.** Dr. J. B. Firth will speak on "Blood Tests and Associated Topics as used in Forensic Work."

A series of four lectures on "The Solid State" is being delivered to the **Royal Institution** by Professor Sir Lawrence Bragg, at 3 p.m., on Tuesdays. The second, on **February 2,** deals with "Plus-minus Compounds," and the third, on **February 9,** with "Minus-minus Compounds."

The next meeting of the Midlands Centre of the **Electrodepositors' Technical Society** will be held, at 4.30 p.m., on **February 2,** when E. H. Laister will read a paper on "War-Time Applications of Precious Metal Plating." It will take place at the James Watt Memorial Institute, Great Charles Street, Birmingham.

A paper on "Recent Developments in Fire Research and Fire Protection Problems," will be presented by Viscount Falmouth to the Structural and Building Engineering Division of the **Institution of Civil Engineers,** Great George Street, Westminster, S.W.1, at 2 p.m., on **February 2.**

At a meeting of the **Royal Institution,** Albemarle Street, W.1, to be held at 5 p.m., on **February 5,** Professor J. C. Drummond will speak on "History and Knowledge of Scurvy and its Treatment."

A meeting of the **Society of Chemical Industry,** Glasgow and West of Scotland Section, will be held jointly with the local sections of the **Institute of Chemistry** and the **Chemical Society,** in the Royal Technical College, Glasgow, at 7.30 p.m., on **February 5,** when Dr. G. Gee will speak on "The Factors Governing the Absorption of Oil by Rubber."

There will be a meeting of the **Institution of the Rubber Industry** at 6.30 p.m., on **February 8,** in the Caxton Hall, Westminster, when Messrs. B. J. Habgood and J. T. Watts will give a lecture on "Practical Processing of American Synthetic Rubber."

The **Institution of Chemical Engineers,** the **Chemical Engineering Group,** the Yorkshire section of the **Society of Chemical Industry,** and the Leeds area section of the **Institute of Chemistry** will hold a joint meeting in the Chemistry Lecture Theatre, Leeds University, at 6 p.m., on **February 8,** when a paper on "The Application of Crystal Analysis to Some Chemical Engineering Materials" will be presented by Dr. A. H. Jay.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

TUNGSTEN MANUFACTURING CO., LTD., London, S.W. (M., 30/1/43.) January 6, £8000 debenture, to Braemore Trust, Ltd.; general charge. *Nil. December 18, 1942.

Satisfaction

BRITISH CELANESE, LTD., Torquay. (M.S., 30/1/43.) Satisfaction January 6, of debenture stock registered June 21, 1934, to the extent of £63,720.

County Court Judgments

HILL, Jno., 152 Nuns Street, Derby, paint manufacturer. (C.C.J., 30/1/43.) £18 18s. 0d. November 18.

MASON, Arthur, and MORRIS, Jas., 1a Farnham Royal, Kennington Lane, S.E.11, welding engineers. (C.C.J., 30/1/43.) £63 16s. 5d. December 1.

Company News

Eliminol, Ltd., 84 Chancery Lane, W.C., have changed their name to Eliminax, Ltd.

Cyclo Solvents and Chemicals, Ltd., Manfield House, 376 Strand, W.C.2, have changed their name to Cyclo Chemicals, Ltd.

Milton Antiseptic, Ltd., announce a final dividend of 7½ per cent., making 12½ per cent. for the year (same).

Maurice D. Curwen, Ltd., 10 Copthall Avenue, E.C.2, have increased their nominal capital by the addition of £900 in £1 ordinary shares beyond the registered capital of £100.

Thompson Brothers (Bilston), Ltd., announce a dividend of 3 per cent. (same), free of tax, on the preference shares, in respect of the six months to July 31, 1943.

Charcoal Industries, Ltd., 108a Cannon Street, E.C.4, have increased their nominal capital by the addition of £2000, in £1 ordinary shares, beyond the registered capital of £1000.

British Essence Co., Ltd., 357 Kennington Lane, S.E.11, have increased their nominal capital by the addition of £9900 beyond the registered capital of £100. The additional capital is divided into 198,000 ordinary shares of 1s. each.

Redfern's Rubber Works, Ltd., announce a net profit, after tax provision, of £14,121 (£13,152), and have declared final dividends as follows: 3¾ per cent. on the A and B preference shares, making 7½ per cent. (same); 6¼ per cent. on the ordinary shares, making 10 per cent. for the year (same), plus a bonus of 2 per cent.

At the annual general meeting of the **British Button Industries Co., Ltd.**, held on January 14, it was announced that the whole of the issued ordinary share capital had been acquired by **Vab Products, Ltd.**, in October, 1942. The net trading profit was £16,226 (£16,167) for the year ended June 30. A final dividend of 5 per cent. on the ordinary shares was recommended, making 20 per cent. for the year.

New Companies Registered

Multi-Plastics, Ltd. (378,384).—Private company. Capital: £2000 in 2000 shares of £1 each. Manufacturers of and dealers in plastics, plastic mouldings and scientific instruments, manufacturing chemists, manufacturers of and dealers in vulcanite, tortoiseshell, celluloid and other goods, etc. First director: B. Leigh. Registered office: 107-115 Long Acre, W.C.2.

Chemical and Allied Stocks and Shares

EARLIER in the week Stock Exchange markets appeared to be developing a cautious attitude, but the tendency in security values later showed a better trend, sentiment having responded to the news of the important Churchill-Roosevelt conference. Nevertheless, at the time of writing, earlier declines have not been fully regained. Compared with a week ago, Imperial Chemical have reacted from 39s. 4½d. to 38s. 9d. and have thus lost part of the good rise shown earlier in the month. Wall Paper Manufacturers deferred units moved back to 36s. following last week's advance to 38s. 9d. when sentiment was governed by news of the extension of the company's plastics interests. Shares of other companies associated with plastics also failed to hold recent gains; Thomas De La Rue were 92s 6d., and British Industrial Plastics 2s. ordinary were quoted at 5s. 1½d xd. The units of the Distillers Co. at 87s. 6d. were within 6d. of the level current a week ago. Elsewhere, B. Laporte were firm at 76s. 3d., and British Drug Houses remained at 23s. Fisons kept at 42s. awaiting the financial results. W. J. Bush were again quoted at 50s.

Burt Boulton changed hands up to the higher level of 20s. Lawes Chemical 10s. shares transferred at 9s. 9d., while Monsanto Chemicals 5½ per cent. preference were again 22s. 6d. Morgan Crucible 5½ per cent. first preference were 25s. 7½d. Elsewhere, firmness was again shown in Borax Consolidated at 35s., the market having remained hopeful that the dividend of the last-named company may be kept at 7½ per cent. General Refractories 10s. shares had a firmer appearance at 12s. 10½d. in response to the hope that improvement in earnings may have continued in the past year.

Iron, steel, and kindred shares were rather more active, buyers having been attracted by the apparently generous yields in some instances. United Steel were 26s. 4½d., Guest Keen 32s. 3d., and Stewarts & Lloyds 53s. 9d. Dorman Long rose strongly to 25s. 9d. on the belief that resumption of dividends may be announced shortly. Elsewhere, Tube Investments were 93s. 6d., and Babcock & Wilcox 50s. 3d., while Allied Ironfounders had a steady appearance at 45s. British Aluminium reacted 7½d. to 49s. 6d. and, in other directions, Dunlop Rubber were 34s. 9d., compared with 35s. 9d. a week ago. On the other hand, Barry & Staines were firm at 39s. 6d., while Nairn & Greenwich were higher at 61s. 3d. having remained under the influence of the financial results.

British Plaster Board remained active, and were again quoted at 27s. 6d., while Associated Cement were 60s. British Match were steady at 38s. 1½d., and Cerebos were at the higher level of £9¾. Among other securities, Murex moved up to 107s. 6d. and, following an earlier small reaction, Turner & Newall rallied to 75s. 6d. There was an improvement in Boots Drug to 39s. 6d., awaiting the interim dividend announcement: Timothy Whites were 27s. 3d., while Sangers were 20s. 10½d. Elsewhere, Goodlass Wall held their recent improvement, dealings up to 13s. 1½d. being shown in these 10s. shares. There was more activity, around 32s. 6d., in Triplex Glass 10s. ordinary. United Glass Bottle shares held their recent improvement to 60s. Financial results of the last-named company fall to be issued in March: the prevailing market view is, that the dividend will probably again be limited to 12½ per cent., bearing in mind the prudent financial policy followed. On the other hand, it is realised that there is a tendency for leading industrial shares to be valued as much on the strength of financial resources as on the immediate dividend yield. Moreover, it is, of course, realised that strong finances will be of great benefit during the eventual change-over to normal activities in the post-war period. In common with the general tendency, oil shares

reacted slightly earlier in the week, but subsequently Anglo-Iranian, "Shell," and Burmah Oil responded to the war news.

British Chemical Prices

Market Reports

THE industrial chemical market throughout displays a very even tone, and a steady volume of new business is reported with values in most sections firm. At the consuming end, deliveries under existing commitments are well up to schedule and a fair number of contract renewals have been made. An active market exists for the majority of the soda compounds and there is also a steady flow of inquiry for borax, formaldehyde, acetone, and the lead oxides. White powdered arsenic is in good demand. Strong markets and limited supplies are the chief features of the potash section, with yellow prussiate of potash nominal and acid phosphate of potash, caustic potash, and carbonate of potash in good call. Trade in the coal-tar section is comparatively quiet and there are no fresh developments to report. There is a steady demand for carbolic acid, creosote oil, and anthracene oil, and also for the benzols and toluols.

MANCHESTER.—Generally steady trading conditions have been reported on the Manchester chemical market during the past week. Movements of supplies of textile and other chemicals are chiefly against existing commitments, users being fairly well covered on the whole, but there has been a fair amount of new inquiry in circulation. Most of the soda products continue to meet with a steady demand, but in the general run of potash compounds the volume of business is still regulated primarily by the quantities available. Sulphuric and most other acids are a steady trade. In the tar products section, an active movement of supplies is principally against contracts.

GLASGOW.—Business in the Scottish heavy chemical trade has been rather quieter during the past week for home transactions. Export trade is still very limited. Prices keep very firm.

The Planning of Science

More Details of the Conference

MORE details are now available concerning the Association of Scientific Workers' open conference on "Planning of Science—in War and in Peace," mentioned in our columns on January 2, page 23. At the first session at 2.30 p.m. on January 30, Mr. E. D. Swann will speak on "The Planning of Science in War," for the Executive Committee of the Association; Sir Philip Joubert will speak on "Some Aspects of the Relations of Science with the R.A.F.," and Dr. D. Schoenberg on "War-Time Science in the U.S.S.R." "War-Time Science in the U.S.A." will be the subject of a speaker as yet unnamed, and Dr. D. Maclean will take as his subject "The Work of the Parliamentary and Scientific Committee."

Mr. T. Halse, chairman of the executive committee of the Association, will take the chair at the second session, devoted to "Local Organisation," at 10 a.m. on January 31. The speakers will include Mr. A. Dooley, on "Chemical Industry," and Mr. R. Innes, on "Co-ordination of Scientific Research and Service Needs." "Determining the Future," is to be the title of the final session, which will take place at 2.30 p.m. Professor S. Chapman will be in the chair, not Professor Bernal, as previously stated, and besides Sir Lawrence Bragg, Professor H. Levy will speak on "The Basis of Scientific Planning." Each session will include a discussion. The conference will be wound up by Professor C. D. Darlington.

MR. E. W. SALT, M.P., has been elected chairman of the Parliamentary and Scientific Committee.

MR. WILLIAM ROBERT MORTON, of the shipping department of the Anglo-American Oil Co., Ltd., died in London on January 25.

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Use it again.
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Printed in Great Britain by THE PRESS AT COOMBELANDS, LTD., London and Addlestone, and published by BENN BROTHERS, LTD., at Bouverie House, 154, Fleet Street, E.C.4., January 30th, 1943. Entered as Second Class Matter at the New York, U.S.A., Post Office.